RAILROAD GAZETTE

FRIDAY, DEC. 29, 1893.

## CONTENTS.



## Contributions.

### Street Railroad Transportation.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Any plan for rapid city transportation must possess the qualities of safety, economy and speed; the latter, however, will not be allowed at the expense of the other two. The cable system has the feature of speed sufficient for most city needs, but it has not proved itself to be either safe of economical; repairs are needed frequently and traffic is often delayed. Both installation and maintenance are costly, and as a system it has been abandoned in many places where much was hoped from it.

The trolley system of electric propulsion has much to recommend it. It dispenses with the conduit needed for the cable, but it demands much street space for its wires and their protection, and this has caused much complaint from the fire departments of every city that has adopted it. It is capable of working at any limit of speed, and with a much higher degree of economy than the cable system, but complaints are made of its danger, though this is overestimated.

In and about Boston there has, at times, been much clamor against the trolley system mostly instigated by companies interested in a secondary battery system from which much has been hoped for during 10 years, but the great weight needed to provide current for a single car, the danger of short circuiting and the necessity for an expert to run every car to look carefully after every cell every day, have prevented the use of secon dary batteries hitherto and seem likely to in the future. The cost of maintaining such a system makes it quite out of the question for adoption. No community would be willing to pay the bare cost of such transportation, to say nothing of a return on the investment. What improvements may yet be made on such batteries I cannot tell, but at present there is no one I have knowledge of that would answer the purposes of city transportation. The secondary battery is an important electrical device and has its proper field, but street car propulsion is not its proper work.

There, then, is the possibility of employing steam power, which would be economical enough and safe and rapid, but the common type of engine requiring fuel and stoking, with its escaping steam, smoke and noise, cannot be allowed in any place. But there is a modified form of steam engine which dispenses with all of those objectionable features while retaining the efficiency and economy of steam propulsion. Superheated water may be endowed with a great deal of energy which may be drawn upon at will without the customary furnace, so that a relatively small amount of water may contain energy enough to propel a train for a good many miles without any fire. This motor starts with its supply of water heated in another boiler and transferred to it through a pipe just before starting. With suitable condensers the steam that has done its work is not allowed to escape into the open air, but is retained. As steam is really the cheapest available source of power for most places, it is plain that for even street car propulsion it would be much more economical than either of the other methods already mentioned. The novelty of such a method might at first be thought objectionable, as was each of the other systems when first used, but there is no reason at all for thinking it will not be as safe, as rapid and very much cheaper than any other system now or likely to be devised. In principle it is all right, and I am of the opinion that with proper business tact and financial support such a motor has a great field.

A. E. DOLBEAR.

[A motor fulfilling the description given in the last paragraph of Professor Dolbear's communication has been tried at intervals recently on the Western avenue line of the West Chicago Street Railway. A description of the trial of this motor, known as the Augamar kinetic motor, was given in the *Railroad Gazette* Sept. 8, 1893.—EDITOR RAILROAD GAZETTE ]

### Shifting Track on the New York, New Haven & Hartford.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reference to article about "Moving Track on the New York, New Haven & Hartford," which appeared in your issue of Dec. 1, it has occurred to me that some additional details bearing upon the actual direction of the work would be of interest and might prove of some value to your readers.

The success of such undertakings is in great measure dependent upon the foresight which anticipates the possible difficulties which may arise during the progress of the work, and to provide for the necessary men and tools to economically meet such difficulties as may develop.

The work above referred to was planned by Mr. Elwell with great care, and the fact that his written "lay-out of work" to the men was rigidly adhered to in every detail, and the undertaking carried to a successful completion without any friction or hitch, indicate how thoroughly he studied the details of the work, and bear ample evidence of the completeness of his preparation.

In reading the description of the work as it appeared in the *Railroad Gazette*, two questions very naturally arise in the minds of practical trackmen, viz.: What height of lift was it deemed best to skid? and how was the longitudinal movement of the track effected? Knowing the suggestive as well as positive value of such details to those who may engage in similar work, I determined to supplement your article by briefly answering those queries.

In answer to the first question, will say that Mr. Elwell finally determined to make the initial cuts at the two ends of the track to be shifted at points where the new embankment was about 2 ft. higher than the old, so that the sections of track from zero at each end extending to points where the lift was 2 ft. high, the shifting was performed by direct throws with lining bars, while the balance of the track having 2-ft. lift and over was moved on the skids as described in your article.

This arrangement proved so satisfactory that the same division has since been followed. The slope of that portion of the new embankment which was less than 2 ft. higher than the old grade had been more or less tramped down by the movements of the men so that little trimming was required to prepare it for throwing the track with lining bars.

In answer to the second question, will say that because of the curves in the alignment and the breaks necessitated by the two bridges, the five-rail length sections of track, which were moved on skids, had to be shifted longitudinally, in one case requiring a movement of some 3 ft. For this purpose the 150 men who had been employed at the skids were supplied with bars, which were placed under the rails between the ties, and with 150 men, one on each end of the 75 bars used, each 150 ft. section of track was, by easy movements, carried backward or forward so as to close up the gaps or correct the laps, as the case might be. By drawing the spikes from the worthless ties in advance of the shifting of track, the old ties were left in their beds and considerable handling of old material was avoided.

While such details may seem trifling in themselves, yet it is the anticipation of them that tends to insure the success and minimizes the cost of such undertakings.

The cost of the Indian River work was a trifle less than 7½ cents per foot of track moved and restored for traffic.

TRACKMAN.

### The Louisville & Jeffersonville Bridge.

NEW YORK, Dec. 25, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It would still be premature to pronounce a decided opinion upon the causes which led to the fall of the falseworks of this unlucky bridge; but as to the fall of the nearly finished span, we now have sufficient data to justify a definite judgment. The fall of this span is of much more general interest than that of the falseworks; for if its parts were thoroughly secured together, as is claimed by its makers, then we must assume that all of our long-span bridges are in a dangerous condition, liable to be overthrown by such a wind as destroyed this one—a wind certainly strong, but not strong enough to blow men off the top of a pier or to upset a pile-driver. Such an assumption is incredible, and it seems probable that the parts of this span were not properly fastened together.

The available evidence with regard to the condition of the span which fell begins with the letter of the Chief Engineer, which appeared in the *Railroad Gazette* last week, page 928. He says: "At least four-fifths of all the holes were filled with bolts. This we know positively to be the case, as it was the subject of special instructions to the foreman about ten days or two weeks before the accident happened, and a special gang was sent over to put in this full number of bolts." It will be observed that it is known that the bolting was properly done because orders had been issued to do it, and not because an examination showed that it had been done. The next piece of evidence is Mr. Thatcher's letter to the *Engineering Record* of Dec. 23. He says: "The end braces (posts) are spliced at the center, near the foot of the portal braces, and, being only temporarily fastened, were not prepared to take the bending moment due to any considerable amount of wind." This view is confirmed by Mr. Cornwell in his letter appearing in same journal. He says: "I found that at the joint in the southeast end post there had only been 17 bolts used in 47 rivet holes visible.' This illustrates the truth of the old adage: "For want of a nail, the shoe was lost. For want of a shoe, the horse and rider were lost."

Probably the true office of wind bracing is often misunderstood or neglected in designing. Horizontal bracing, above and below, prevents the whole span, forming a square tube, from yielding sideways to wind pressure. But the fall of spans from this cause is rare, as nothing but a violent cyclone has power enough to break a bridge apart in this direction.

Vertical or sway bracing prevents each truss from revolving on its base and falling over sideways. This takes less wind power and is a more common cause of bridge failure. This was undoubtedly what happened to the Louisville Bridge. Upper horizontal bracing is of no use unless connected with massive portal bracing, and unless the end posts are strong enough, as seems not to have been the case at Louisville.

It seems probable that this accident will result in more strength being given to vertical bracing and its attachments, and, in very long spans, to greatly increasing the size and strength of the end posts. It is also most essential that the bottoms of the end posts should have gusset plates connecting them with a transverse member uniting the lower ends of these posts together. It would also be a wise precaution in long spans to unite the feet of all the intermediate posts to the transverse floor beams with similar gusset plates.

Moral: In very long spans you cannot have too much vertical, or sway, bracing.

T. C. CLARKE, C. E.

PHŒNIXVILLE, Pa., Dec. 26, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

We have nothing further to report regarding the Louisville accident, excepting we may state that we notice in the *Engineering Record* of this week, conclusions that are based upon wrong assumptions, and as we are all deeply interested in learning the correct cause, it is well to start with the facts as they exist.

*First.*—The falsework had been placed in the river in strict accordance with plans and had been subjected to a rise of at least 10 ft., which, from examinations made before and since the wreck, we know scoured out to some extent the first few bents immediately adjoining the Indiana pier.*

*Second.*—The piles below the caps were braced with three lines of X bracing from pier to pier and this bracing was entirely completed four or five days before the the accident occurred and before any iron was placed on the falsework.

*Third.*—The metal of span fell up stream and the fixed end landed in the river at least 30 ft. above its support on the pier. This absolutely precludes any failure in the plane of the lower lateral system, from the fact that had it failed at this point the lower chord on the windward and down stream side would have buckled and the span would have fallen down stream.

*Fourth.*—As before stated the entire floor system was riveted complete throughout ready for use, all other joints were thoroughly well fitted up with at least four-fifths of the holes filled with bolts, this would give at least 70 bolts at the connection of lower portal struts with the end post. Had the span failed at this point it would have rotated around the up stream and leeward column, and would have fallen in the river with probably the top of the bridge on the bottom and the floor showing, and as the up stream column foot left the pedestal it would certainly show signs of this scraping either on the pedestal or on the coping, but such we find not to be the case. The pedestal left on the pier shows not the least sign of any such movement, and the pier is not injured at this point in any particular, nor do we find the wreck in the position we would expect to find it from this cause.

We simply call your attention to the above points from the fact that we understand they have been brought out in one or two discussions. From the condition of the work before the disaster and from the condition afterward, we are still of the opinion that the span was lifted near the fixed end and blown up stream. As you may notice from photographs, it fell far enough up stream to entirely clear the tops of several bents of piles, sticking out of the water at least 15 ft. and extending about 100 ft. under the span from the Kentucky pier.

THE PHŒNIX BRIDGE CO.,
*Jno. Sterling Deans, Chief Engineer.*

### The Hudson River Bridges.

NEW YORK, Dec. 19, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your editorial on the Hudson River Bridge, in your issue of December 15th, can hardly be left unnoticed by me, since to remain silent would give the color of truth to the statements therein.

One of them is that the scheme of the North River Bridge Company, with which I am connected as Chief Engineer, will cost $80,000,000, which, it is alleged, is

* The falseworks failed at this point.—EDITOR.

$40,000,000 more than the scheme of the so-called New York and New Jersey Bridge Company.

You were possibly misled into believing such a grossly incorrect and wholly unfounded statement by hearing that the North River Bridge Company is providing for a capital of $100,000,000, and that the bridge plans as submitted to the Secretary of War provide for ultimate 14 tracks; both of which are facts. But these provisions are entirely precautionary, for growth in the future, which may be more or less rapid, and for which the funds should be obtainable when needed. For the beginning, the installment of six railroad tracks and two streetcar tracks and an expenditure of less than $40,000,000 will be sufficient, and more is not contemplated. It may take years after the completion of the bridge before the transportation interests will adjust themselves to it, and then it will be time enough to add gradually to the capacity of the superstructure and of the terminals, for the increasing business certain to come. The plans of the bridge and terminals provide for expansion, a precaution amply justified by experience elsewhere. Your contention, therefore—which is merely the echo of the by no means disinterested assertions of a rival bridge scheme—that our bridge is a financial impossibility, has no facts to rest on. On the contrary, it is conceded by the railroad interests most concerned that, every condition considered, a cheaper and more favorable location than ours cannot be found anywhere else along the river. On it we will not only give a short and direct entrance to the principal railroads in New Jersey on the comparatively least expensive right of way that can be found, but we will be able to give rapid transit to Hoboken, West Hoboken, Jersey City Heights and all the territory south, north and west thereof, a source of revenue which is too important to be neglected.

As to the practicability of a single span of 3,100 ft., if such is decided, I will not waste argument. No bridge engineer worthy of the name can have any doubt about it. It is the same old experience with ignoramuses who assert that, because there is no precedent, the bridge is not practicable. It will suffice to say that the amount of metal and masonry in the bridge is absolutely known, and responsible contractors are ready to execute the work under adequate bonds as soon as the order is given. The structure is so designed that without interruption of traffic, its capacity may be gradually increased as needed in the future. The cost is cheaper than for submarine tunnels, and is not prohibitive for either bridge.

If piers are permissible in the North River, then there is no good reason in the world why, on the respective locations, one bridge should have the right to build them and another bridge, alongside of it, should have that right denied to it. Even the shipping and commercial interests admit the fairness of this position, although they are opposing piers for both bridges.

You also express your belief, that I concede certain views, which you state, as to the distribution of traffic across the river by a bridge. In this you are also mistaken. I do not hold the views with which you credit me. Regarding them, I would refer you to an article which I contributed to the *Engineering Magazine* in November.

Your doubt as to there being enough business for two bridges is of course well enough, and shared by all, except the promoters of the parallel scheme. They came to Congress after the North River Bridge was chartered and, with the cries, "There must be no monopoly," "Competition is the life of trade," "New York wants a bridge at every street," and other clap-trap arguments, proceeded to convince Congress of their philanthropic intentions. No railroad interest gives them countenance. What all this means is very plain to those who had similar experiences with other large enterprises. "*Ex uno disces omnes.*" GUSTAV LINDENTHAL.

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DEC. 26, 1893.

To many of your readers it may seem strange that the North River Bridge Company has no charters from the States of New York and New Jersey, as stated in your editorial of December 19. I would therefore request of you to kindly give space to the explanation, that the North River Bridge Company is a Federal corporation with all the needed powers for its undertaking, these powers to be exercised in accordance with the laws of the respective States wherein its works are located. The charter is not a mere license act from Congress, as is usual for bridges over navigable waters, but in its legal aspect is similar to that of the Union Pacific Railroad and a few other Federal interstate railroad corporations. It is placed under the closest supervision, and its accounts are subject to the examination of the expert accountants of the Interstate Commerce Commission, to ascertain the cash cost of the undertaking.

The company was legally advised against state charters, and the reasons therefor were at the time fully explained by counsel to Congress (from 1888 to 1890). The suit (since 1891) now pending in the Supreme Court of the United States will determine, probably in two or three months, certain questions under the Federal charter, and until then the company, for prudential reasons, defers starting the work of construction. It may be remarked that careful bankers and capitalists, here and abroad, are not satisfied now with legal opinions as to the rights of new corporations. Some heavy losses and very expensive experiences with charters, which did not stand the test of litigation (like the Arcade Railroad, under Broadway, and several others in New York, and a recent instance with elevated railroads in Philadelphia), taught the necessity of having their legality adjudicated before risking large sums of money on them. It is not likely that bridge charters from the states will command great faith until they have been likewise legally tested.

As to the possible cheapening of the plans of the North River Bridge Company, mentioned in your last editorial, I may say that there is nothing in the location or in the engeering conditions of the project preventing the cost from being cut down to $23,000,000 for a four-track line into New York over a single-span bridge, and possibly to a smaller sum over a pier bridge, if certain provisions of the company's charter, as to capacity of bridge and terminals, could be ignored.

If the company should be legally advised, that, under the changes of law now developing, it can be done, it may perhaps be yet so determined, although this is only my opinion. GUSTAV LINDENTHAL.

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## Differences Between American and Foreign Locomotives.*

The locomotives of the United States are not so different from those of foreign countries as might be supposed from the outward appearance; most of the differences are in details, and result from differences in operation, which demand in the United States a large increase in the general dimensions. In studying distinctive features of locomotives of all countries, it is necessary to know in minute detail the conditions of operation under which each class of locomotives is worked, as it is generally found that engines everywhere are well adapted for the work they do. The main difference between locomotives used here and in other countries is a necessary result of the difference in environment. In other countries, generally speaking, the distances are short, competition small, wages low, and money rentals moderate; in some a governmental control removes all competition. In the United States, long train runs, high wages, sharp competition and high rates of interest define the method of railroad operation so clearly that it is practically beyond the power of any individual company to vary much from the almost universal practice of running heavy trains. It is this necessary policy of heavy trainloads that gives rise to the wide difference which is found in maximum hauling power of the American and foreign locomotive. This increased power demands more weight for adhesion and greater steaming capacity; therefore, one finds the American engines heavier and the boilers larger for similar classes of work. This is shown in tables not reproduced, which give the comparative dimensions of locomotives of various countries.

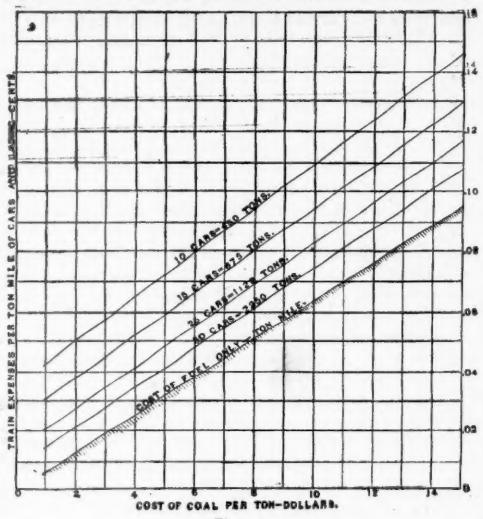


Fig. 1.

Many of us in the United States have thought that certain details that are universal here, such as the equalization of the weight between driving wheels, the four-wheeled swiveling and lateral motion truck, outside cylinders, the firebrick arch and iron tubes, etc., are not commonly used in other countries, and formerly they were not; but now equalizers are common in England, they are standard in Germany, common in France and in other European countries. Outside cylinders are quite universally used in Germany, are common in England, and frequently used in France, Italy and other countries. Fire brick arches, iron and steel tubes, and lateral motion swiveling trucks are quite common, although not the rule everywhere. So that in looking for such general features of design of locomotive details as are peculiar to the United States, one finds at the present time but little beside steel fireboxes, bar-frames, cast-iron wheel centers, and tenders with swiveling trucks. There are many peculiarities in minor details, but these do not affect in any material way the economical operation of the engines.

The use of cabs is dependent, not upon the country, but upon the climate, and they are generally found where the winters are severe. As a rule, all differences in the designs of details can be traced directly to the relative prices of labor. Where labor is high; designs are simple; duplication and interchangeability overrule minor features of durability and efficiency, and in general cast pieces are used instead of wrought. For instance, in the United States the duplication of parts receives more attention than in foreign countries, and it is common to use a clumsy, heavy cast-iron piston, that requires less hand labor than the foreign type of piston (the Swedish), which is one of forged steel, very light and strong. Also driving-wheel centers are here made of hard cast iron, while in Europe they are almost universally made of wrought iron.

We are all more interested in such features of locomotive construction as affect the operation than we are in the parts which affect the cost of repairs, for the reason that the other costs of locomotive service are the major part of the total and greatly exceed the repairs. Again, the cost of repairs is so dependent upon the facilities and the price of labor that it is impossible to learn much about the relative merits of designs from a study of the cost of repairs in different countries. Facility for making repairs is the all-important factor of repair costs. Take, for instance, the renewal of driving tires. In this country it was formerly the custom to take an engine into the shop for repairs whenever the driving tires needed turning; in this way the repairs of locomotives were largely dependent upon the durability of the tires. Now, this has entirely changed, and in the most advanced shops general repairs are made only when they are needed. A locomotive may come into the shop in the morning with bad tires and axles, and be sent out again at noon with a new set of wheels complete or a new set of tires put on ready for use. The improvements in handling heavy parts and in other facilities for making repairs have materially reduced the cost of keeping up locomotives, so that it is impossible to say what are the advantages of those details of construction which are more common in the United States, without knowing the comparative facilities for making repairs; and, furthermore, the difference in the condition on different roads in any one country, in the United States for instance, is great enough to give entirely different results in the cost of locomotive repairs per mile run.

Lack of accurate information has led to considerable discussion within the past two years about the mileage of locomotives before being sent for "general repairs;" but there is no accuracy in comparisons in matters of this kind between locomotives used in different countries, as the conditions are so different. It is not to be expected that a locomotive hauling heavy trains can run so long without a general overhauling as with comparatively light trains. However, it is not the weight of train that governs the mileage made before "general repairs." The term "general repairs" is indefinite, and some roads keep up the majority of the so-called "general repairs" without taking the locomotives into the shop, while on the other roads some of the "running repairs" are classed as "general repairs," owing to the lack of facilities which compels the locomotive to be considerably dismantled before the parts needing repairs can be made accessible. Therefore, in considering the comparative features of locomotive practice of different countries the writer has adhered closely to the general features of construction, omitting the minor parts, about which it is impossible to reach a conclusion without knowing in minute detail the conditions and facilities in each particular case; also, such special types of engines as are used in suburban service and for heavy grades are omitted, as they are not common enough to entitle them to be classed as regular practice.

It is not within the scope of this paper to say much about different methods of operating locomotives, but operation so controls designs that one must be understood if the reasons for the other are to be comprehended. The dispute about the economy of running heavy trains has arisen almost solely on account of a lack of definite information on the subject. One may safely grant that if there was any defect in the policy of heavy loads, the exceedingly sharp competition in the United States would have long ago developed the defects, and we should now find some of our roads hauling light trains at frequent intervals. To the contrary, the practice of heavy trainloads is universal here. An examination of the cost of freight train expenses in this country, as given by Fig. 1, will show how great is the gain by increasing the trainloads when the price of fuel is moderate. The average weight of a foreign freight train, exclusive of engine and tender, is approximately 450 tons. Trains are much heavier on the continent of Europe than in Great Britain. The average weight of an American freight train for level roads is not far from 1,350 tons. Table B gives the data on which fig. 1 is based. In this table the coal used per ton-mile of total train is taken as a constant for all weights of train. This is only approximately correct, but it is quite near enough for the comparison now being made, as the coal per ton-mile of total train does not vary much with different trainloads when the power of the locomotives is in proportion to the train.

The coal per ton-mile of total train is taken as .1275 lb. This corresponds with good practice in the United

* Extract from a paper prepared for the International Engineering Congress of the Columbian Exposition, 1893, by David L. Barnes, M. Am. Soc. C. E.

States. The wages of train crews in this country, or any one road, are nearly the same for all trains.

TABLE B.

| No. of cars | Wt. of cars. Tons. | Wt. of locomotive and tender. Tons. | Engine crew wages per mile run. Cents. | Train crew, wages per mile run. Cents. | Coal used per ton-mile of total train. Pounds. | Oil, waste and repairs for locomotives per mile run. Cents. |
|---|---|---|---|---|---|---|
| 10 | 450 | 70 | 5.33 | 7.25 | .1275 | 3.62 |
| 15 | 675 | 75 | 5.33 | 7.25 | .1275 | 3.62 |
| 25 | 1,125 | 85 | 5.33 | 7.25 | .1275 | 3.62 |
| 50 | 2,250 | 95 | 5.33 | 9.25 | .1275 | 3.62 |

The cost per useful ton mile for train wages is, in general, the controlling element here, and it decreases as the trainloads are increased. In the fuel account there is a saving from heavy trainloads up to the point where the engine is excessively overloaded. This is frequently observed from tests of locomotives, but no account is taken of it in the diagram. Take two locomotives and give one a heavy and another a light train; the one with a heavy train will use more coal per mile, but there is a greater useful load in proportion to the dead load of locomotive and tender, and the resultant coal per useful ton-mile is less with the heavy train than with the light train. This reduction in cost of transporting useful loads goes on, even after the load is increased, to a point where the scientific steam engineer would deem the locomotive to be too much overloaded for the economical use of steam. So much bearing does the environment of condition and cost of wages have on the policy of locomotive operation that in the extreme cases where fuel is less than $1 per ton the most economical trainload is the maximum load that can be hauled by one engine almost regardless of the economy with which the steam is used; this is shown by fig. 1. So, then, in the United States, heavy trains, high wages, sharp competition and high rates of interest fix the main distinctive feature of American locomotive practice, which is the greater hauling power of the locomotives. The greater power is obtained in two ways; first, by using locomotives of greater weight, and second, by forcing the boilers to a degree almost unknown elsewhere.

Outside of the greater hauling power, which necessarily requires greater weight and larger parts, and the forcing of the boilers and the machinery, which increases the wear and tear, there is not as much difference in locomotive practice here and in other countries as is generally supposed. From the external appearance of locomotives of different countries, one is led to expect important differences in the vital parts of construction; thus the smoothly encased European locomotive, with a weather shield instead of a cab, often appears to be quite a different machine from the American locomotive with its structural parts exposed to view and with a small house on top of the boiler; yet the organic differences are really small. Each has a pair of single-expansion steam cylinders, either inside or outside of the frames, to which the steam is admitted, and from it allowed to escape by a single plain slide valve actuated by a link motion and eccentrics. The boilers are both internally fired and have approximately the same arrangement of tubes and parts. The frame construction in both consists of two horizontal and longitudinal beams, made either of bars or plates. The guiding and carrying trucks are perhaps more generally used in the United States, but not to an extent that would justify the claim that a swiveling truck is a distinctive feature of American locomotive practice. Carrying trucks have sometimes two wheels, and again four wheels. Sometimes they swivel, and in addition swing laterally. Where they do not swivel or swing laterally, considerable end play is allowed in the bearings, which gives them, to a considerable extent, the equivalent of a lateral motion. Many engines in the United States are without lateral motion in the tracks, and in Europe one finds many trucks that both swivel and move laterally.

The drivers and connecting rods of locomotives of all countries are alike in all functions; and so on, throughout the principal details, there is but little in the general purposes of construction that can be considered distinctive differences, or differences that should materially affect the economy of operation under the same and equal conditions. However, few as are the important differences in general features, yet there are many and great differences in detail when viewed from the standpoint of the experienced locomotive builder. These differences do not affect the economy of operation, but govern somewhat the durability and affect mainly the amount of labor required in construction, and thereby influence the first cost.

The important distinctive features of American locomotive practice are: large dimensions, great hauling power, duplication of parts, steel fireboxes, bar frames, the univeral use of equalizers for all types, and cast iron driving wheel centers; these are manifest advantages from an American standpoint; also, as distinctive features and of questionable advantage, are tenders with swiveling trucks, and small drivers for high speeds. A distinctive feature and a decided disadvantage is the use of heavy reciprocating parts.

The locomotives used in foreign countries are now, generally speaking, of about the same weight and power as those used here 10 years ago, and the heaviest foreign types for passenger service are about the same weight as our light eight-wheel type. There are none used elsewhere on comparatively level roads that are as powerful as our 10-wheel and mogul express engines. Abroad there are many and varied types of locomotives, and abrupt changes in construction are more common than in the United States. So varied are the plans followed, and so rapidly do the changes in important details take place that the onlooker receives the impression that a general dissatisfaction exists. Recent developments have followed American plans, both in weight and type, in a way that is complimentary, and there is some evidence that when foreign locomotive designs become more constant, and the process of selection evolves a nearly universal set of types, some of the features that are now distintively American will find a place in the ultimate plan. One distinctive feature of the American locomotive construction that will eventually become universal is the steel firebox. The policy of hauling heavy trains, which is a distinctive feature of American locomotive practice, is so clearly advantageous that sooner or later all countries having long distances and competition between common carriers will run heavy trains, and will construct ponderous locomotives to haul them.


Fig. 8.—Louisville & Jeffersonville Bridge.

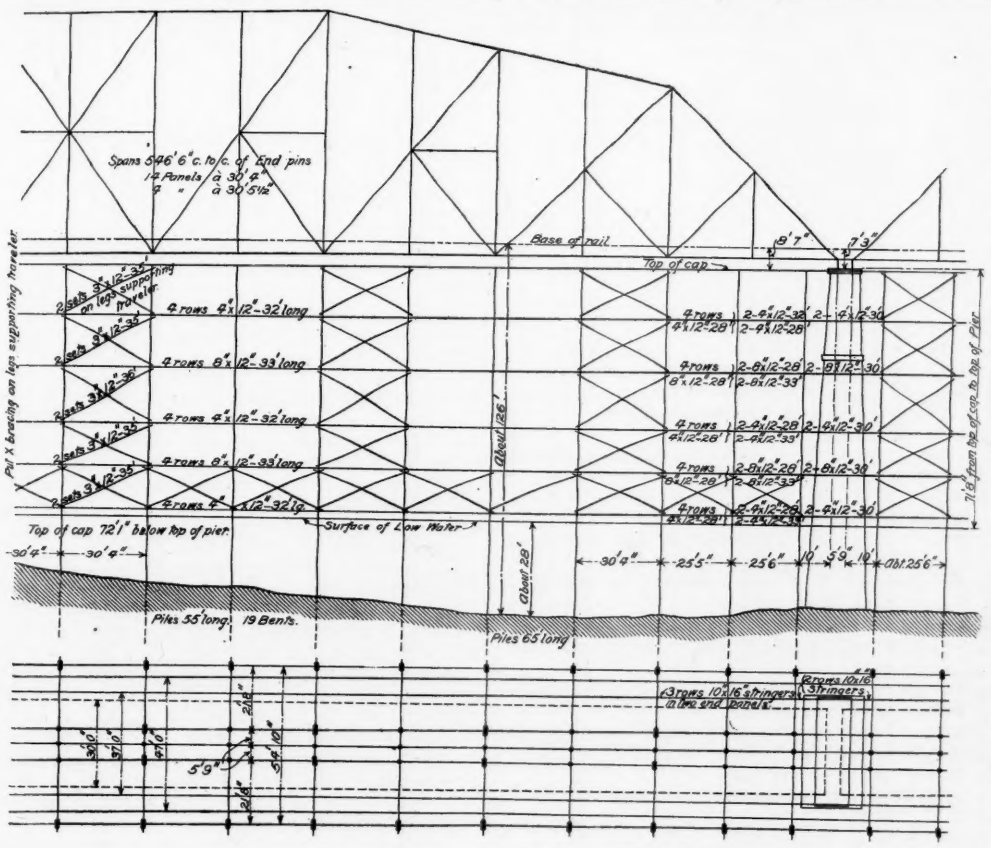



Fig. 1.—Falseworks, Louisville & Jeffersonville Bridge.

## The Louisville & Jeffersonville Bridge.

We illustrate herewith the bridge and falseworks that recently collapsed at Louisville. Fig. 1 shows the timber falseworks upon which the bridge was erected and which was probably the primary cause of the accident. It consists, as may be seen, of piles from 45 to 65 ft. in length, driven into the river bottom for a distance of about 15 ft. These piles are not braced for 30 ft. from the bottom to the surface of the water. They are braced at the top longitudinally and vertically for a height of 14 ft. The longitudinal and transverse bracing are shown in figs. 1 and 2. On top of these piles is erected a timber trestle 71 ft. 8 in. in height, of four vertical divisions braced transversely by 3×10 and 3×12 diagonal braces and 12×12 caps and 3×12 intermediate horizontals. This trestle was braced diagonally at every third panel, as shown. There were 19 of these bents in the

span of the bridge, making them 30 ft. 4 in. apart. The sizes and dimensions are given upon the disgram and little more may be said to describe it. What strikes one at first is the 30 ft. length of piles from the bottom up, without any bracing whatever. This must have been an element of weakness, and if 30 ft. when constructed it was in all probability much more in consequence of the scouring of the bottom due to the contracted waterway.* Without inspection the amount of this scouring cannot be estimated; it may have been considerable. The weight of the bridge as given is 900 tons and the falseworks may be taken roughly at about 700 tons, which would give 1,600 tons upon the 160 piles of the falseworks, or ten tons on each pile, which would not be excessive if the bottom into which they were driven was not disturbed or moved, and if they were properly braced to prevent buckling.

The traveler was not unlike those generally employed for the erection of superstructure, but it is a little top heavy, the width at the top being 61 ft., and at the bottom 47 ft., the total height above the track 102 ft., and the extreme width of track 47 ft. It is securely braced by diagonal timbers. In appearance it suggests nothing unusual and should be fully equal to the purposes for which it was designed if properly braced and guyed, with sway braces. According to reports the sway tackle had not been put on, but was being adjusted when the accident took place. The falseworks underneath the traveler gave away and precipitating it into the river, the rest falling in upon it.

The piles were already loaded to their safe limit and the additional load of the traveler blown by the wind so as to throw its weight upon the up-stream outer post and perhaps on to one of those alternate bents with but one single pile under the post, and with insufficient diagonal bracing in the first story to distribute the thrust over all the piles it of course gave way, and the rest of it followed.

The next element which meets the eye of a critic is the fact that no horizontal transverse bracing is shown in the drawing nor on the bill of materials, nor is any mentioned in the engineer's report. Without horizontal transverse bracing of the trestle there was little to prevent any one or two of the bents from being blown out from under the superstructure almost independently of the other bents. That such a part of a high trestle work should have been entirely omitted is not so surprising, for it is not unusual, but a careful engineer should have insisted on its being secured by such bracing. Whether the diagonal longitudinal bracing of each third panel is sufficient for such a high falsework (72 ft.) is a matter of considerable difference of opinion. Under such a load it may well be doubted if the trestle work would stand after one bent had been wrecked by the traveler or blown out by a strong wind, with only two sets of 3×10 or 3×12 in. diagonal braces between the bents of every third panel.

The fact that it gave way would seem to sustain this doubt. The transverse bracing of each bent is also as light as it could be with any degree of safety. The first story above the top of the piles of 16 ft. 9 in. (see fig. 2), has but two 3 × 12 diagonal braces, and they are so placed that they do not distribute the load that comes on the outside posts over the other piles. A double system of bracing should certainly have been employed as in the panels of the stories above.

This is not the first time that the Phœnix Company has suffered from the loss or failure of falseworks, and every bridgeman knows what difficulty is experienced to get the erecters in the field to follow scrupulously and carefully the designs and plans of falseworks sent out from the office. And, furthermore, the company must have had its attention called to the necessity of subaqueous bracing of the piles and to longitudinal transverse bracing before this accident occurred.

That the timber employed was new and of Southern pine is to the company's credit, but we cannot help expressing our feeling that the falseworks as shown and described were weak, at least in these two or three points, namely, the lack of bracing of the piles below water, the absence of horizontal longitudinal bracing, the lack of diagonal braces between successive bents, and of two diagonals in the lower story of each trestle bent.

In expressing this opinion we do not wish to cast any reflections upon the Phœnix Bridge Company or its methods, but to rather make our criticisms general, that it is a universal bad practice to erect cheap, hurried structures for falseworks that are entirely insufficient to withstand the high water and winds to which they are liable.

This is proved by the four other disasters that have taken place right there on the Ohio River within a few years, and described in our last week's issue. Very likely the Phœnix company exercised as much care in the selection of the material and in the erection of the falseworks as is usual in such places and under such conditions; but it is safe to say, too, that before many more such accidents occur, bridge companies will give more attention to the weaknesses pointed out.

Most engineers will agree that the failure of the falseworks and the resulting fall of the incompleted span is not a matter of much wonder; but how it was possible for the completed span to fall after having been finished and bolted as the Chief Engineer describes, is a matter of great surprise. Nothing short of a cyclone that would have unroofed buildings, blown down trees and

* See Mr. Dean's letter, in another column.

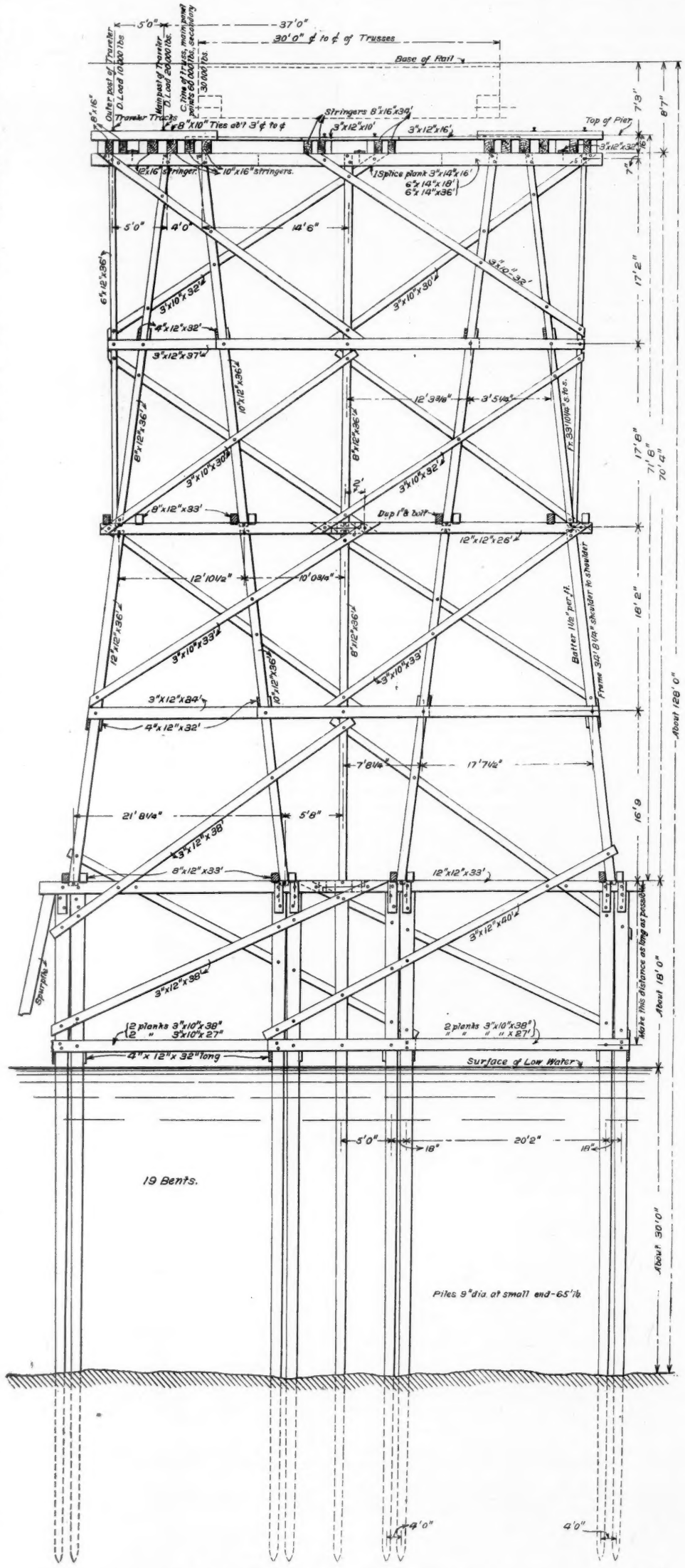



Fig. 2.—Falseworks of Louisville & Jeffersonville Bridge.

destroyed other kinds of property would ever have disturbed in the least a bridge completely erected with its laterals and transverse bracing with four-fifths of all the holes filled with bolts; and the only answer to the statement made by the Chief Engineer, that it was the subject of special instructions to the foreman that this should be done is that like many other things left to the care and attention of subordinates, it probably never was done, or, if attempted, was half done. Engineers will discredit any report to the effect that the bridge was lifted bodily from its piers, or that the wind was strong enough to have any effect whatever upon the bridge.

If the bridge was completed, bolted and the members tightened up, as reported by the engineer in our last week's issue, it must have possessed weaknesses that so destroyed the utility of the bridge that it is a blessing that it went down without a load of human beings. The bridge so erected and completed, with four-fifths of the rivet holes securely fastened, could never have blown down in a wind of 36 to 40 miles an hour. Any such theory is absolutely untenable. In the immediate vicinity of the bridge, scarcely 100 yds. away, and about the same level, is Tow Head Island, on which no damage was done to trees or structures. Investigation will no doubt prove that the top chord connections and the diagonal wind bracing were only bolted, and that, doubtless, insecurely. Reports from an examination of the wreck bear out this conclusion. The pieces of the top chord which can be seen above the water show no riveting of the connections. From the photograph, fig. 8 No.4, which was taken only a few hours before it fell, it may be seen that the laterals and diagonal bracing are in place in the end panel of the lower chord at that end of the bridge. Splice plates designed for 15 field rivets contained but seven bolts, and since these parts were fastened together with about one-third and one-half of the number intended, it may be reasonably taken for granted that the rest of the bridge had been bolted in the same manner, which would account for its failure. The diagonal bracing was doubtless left loose and slack, and if the wind had happened to blow in gusts at such interval as the chords would sway back and forth, it may have occasioned a vibratory movement which doubtless overturned the trusses. The Chief Engineer's statement that the lower chord is at the bottom of the river with the other parts over it, is doubtless explained by the fact that the bridge may have been dragged off from the pier, going down in the position in which it now lies.

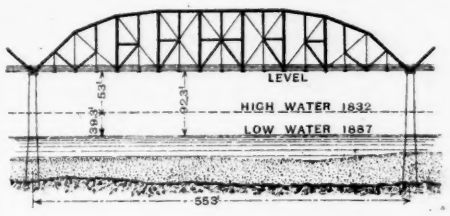



Fig. 3.

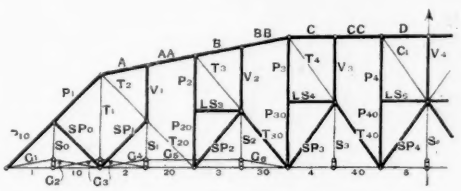


Fig. 4.

The iron superstructure of this bridge was designed several years ago under the direction and supervision of Prof. W. H. Burr, who was at that time with the Phœnix Bridge Company. So far as the design is concerned the bridge has every appearance of being safe and able to withstand any loads or storms to which it is likely to be subject, if it had been properly and completely erected.

Fig. 7 shows the general design of the trusses, which are of the Pratt type with subdivided panels. The sizes and dimensions are given except for the third and fourth panels, in which they are as follows, employing the notation of the diagram fig. 4. The upper chord and end

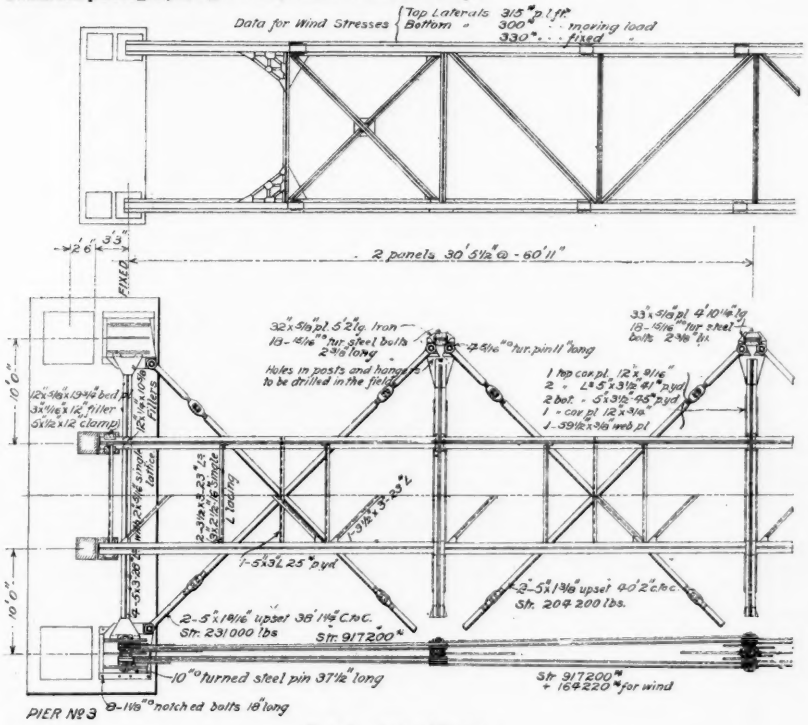



Fig. 5.—Lateral Bracing.

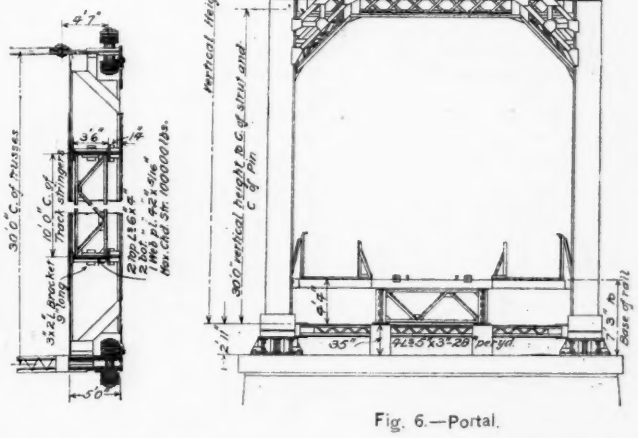



Fig. 6.—Portal.

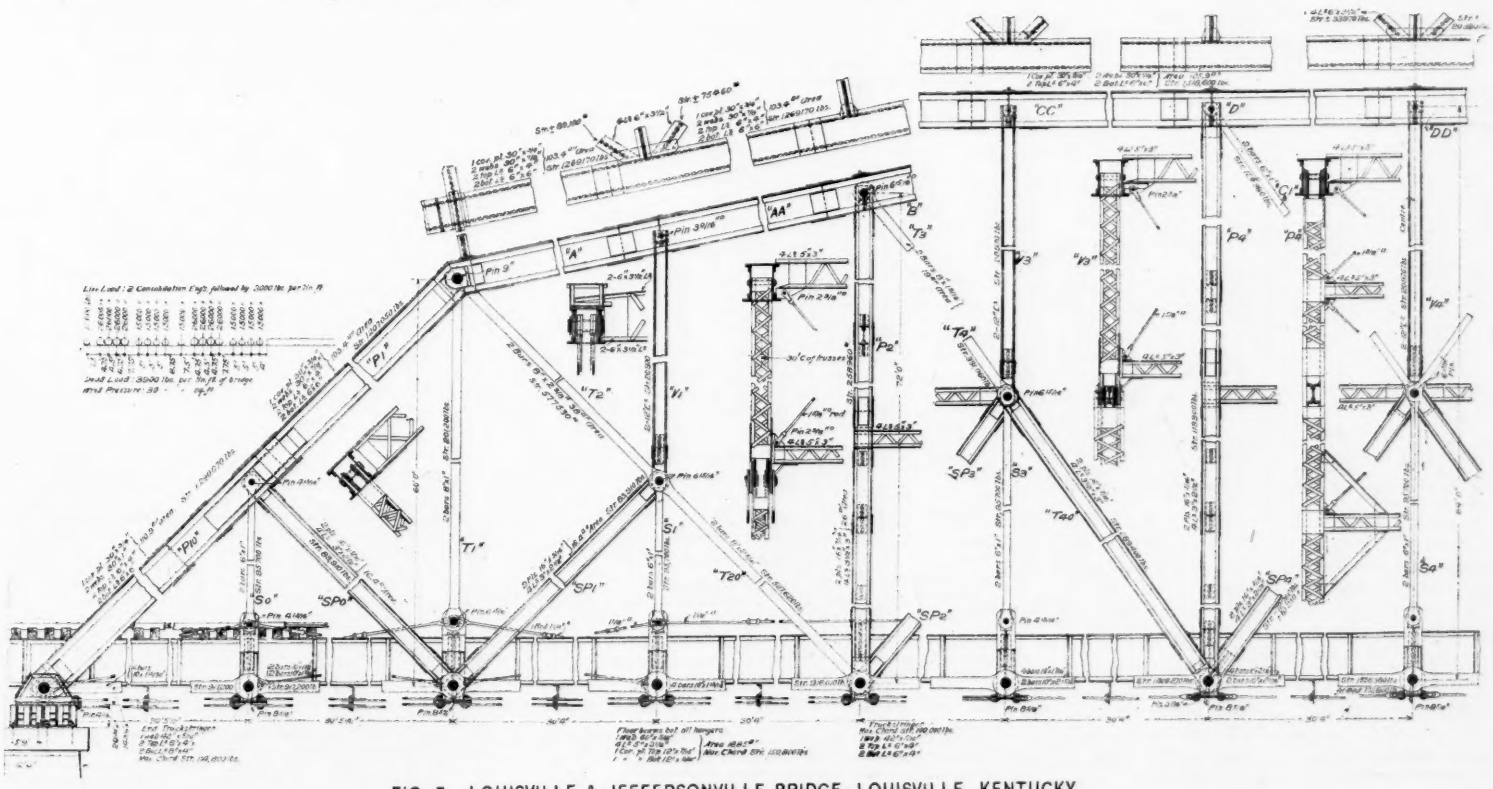



FIG. 7.—LOUISVILLE & JEFFERSONVILLE BRIDGE, LOUISVILLE, KENTUCKY.

THE PHŒNIX BRIDGE COMPANY. JOHN STIRLING DEANS, *Chief Engineer.*

posts of all the panels are built of cover plates 30 in. × ⅝ in., two top angles 6 in. × 4 in., 42 lbs. per yard; two bottom angles 6 in. × 6 in., 100 lbs. per yard, and two web plates 30 in. wide, but of varying thicknesses.

These web plates are for succeeding panels respectively 1 in., ⅜, ⅜, ⅜, 1 1/16, 1 1/16, 1¼, 1¼, and 1¼ in. in thickness. The stresses in the upper chord members of the panels omitted in fig. 7 are as follows: *B* and *BB*, 1,394,890 lbs.; *C* and *CC*, 1,518,600 lbs.; *D* and *DD*, 1,618,600. The lower chords for the panels omitted are made up as follows: Member (3) of 2 bars 10×2 7/16 in. and 2 bars 10×2½ for a maximum stress of 1,289,580 lbs.; member 30) of 4 bars 10×1⅝ in., and 2 bars 10×1 1/16 for a maximum stress of 1,289,580 lbs.; member (4) of 4 bars 10×1⅝ in. and 2 bars 10×1 1/16 in. for a maximum stress of 1,406,270 lbs., connected by 8⅝-in. pins. The diagonal members of these same panels are, (*T* 3) 2 bars 8×1 5/16 in., stress 266,740, (4√2) 2 channels 12 in., 60 lbs. per yd., stress 20,970; (*SP* 2) 2 plates 16 × 5/16 in., and 4 angles 3×2½ in., 16 lbs. per yd., stress 77,190 lbs.; (*T* 30) 2 plates 16×5/16 in. and 4 angles 3½×3 in., 24 lbs. per yd., stresses + 223,930 lbs. and — 27,590; (*S* 2) 2 bars 6×1 in. stress, 95,700 lbs.; (*P* 3) 2 plates 16×5/16 in. and 4 angles 3×2½ in., 16 lbs. per yd., stresses + 124.970 and — 70,950; (*T* 4) 2 bars 8×1 5/16 in., stress 331,960 lbs.; (*S P* 3) 2 plates 16×5/16 in. and 4 angles 3×2½ in., 16 lbs. per yd., stress 72,760 lbs. All built members are latticed and riveted in the usual manner and the same sized pins are used as in the other panels. The heights, widths and distances between centers of pins are shown in the engraving.

Fig. 5 shows the system of lateral bracing in panels 1 and 10, at the top and bottom chords. The top lateral bracing is the same for all pannels, and the diagonal members consist of 4 angles 6×3½ in., 33 to 36 lbs. per yd., and are calculated to carry maximum stresses of from 6,790 to 89,100 lbs. These members were to be riveted to the top chord as shown, and load of the system was 315 lbs. per lineal ft. The bottom lateral bracing consists of diagonal tension members bolted or pinned to plates which are riveted to the ends of the vertical posts and floor beams.

The stresses given for these diagonal tension members for each subdivided panel are as follows: 231,000, 204,200, 178,600, 152,900, 128,380, 104,600, 81,630, 59,420, 37,950 lbs; the loads having been taken as 300 lbs. moving load and 330 lbs. fixed load. The sizes of these tension bars in the panels not shown are: For the 3d panel 2 bars 5×1 1/16 in. with upset screw bars; 4th panel, 2 bars 5×1 in.; 5th panel, 2 bars 3½×1¼ in.; 6th panel, 2 bars 3½×1 in.; 7th panel, 2 bars 3½×⅝ in.; 8th panel, 2¼ round rod; 9th panel, 1⅝ round rod. Both rods are provided with turnbuckles, and are fastened at their intersection to the track system.

The transverse wind bracing consists of horizontal compression members between the posts at the upper chord and at half the height of the post tied by diagonal tension rods. These members are built of four angles 5 × 3 in., 25 lbs. per yard, latticed together, two at top and two at bottom. Two diagonal tension rods are 1⅝ in. round iron between posts and 1⅜ in. between the posts of the subdivisions. The horizontal transverse member at the upper end of the end post is heavier and deeper than the others, consisting of two top and two bottom angles, 6 × 3½ angles, 33 lbs. per yard. The portal is shown in fig. 6, which shows also the general placing of the ties and track.

## Draft Appliances on Locomotives Exhibited at the World's Fair.

What follows is an abstract of the paper presented by Mr. Willis C. Squire at the November meeting of the Western Railway Club. We have condensed the paper considerably, but have tried to retain that which is most essential.

No. 1, fig. 1, is a short front end with a petticoat pipe placed above a short exhaust nozzle, and a perfectly free and unobstructed straight stack.

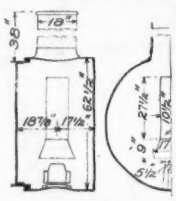


Fig. 1.

No. 2, a short front end, with long exhaust nozzles, and a plain piece of netting placed horizontally. Stacks are both straight and tapered.

No. 3, fig. 2, extension front ends, long blast pipes and a perfectly plain arrangement of netting, which extends forward from the baffle plate, horizontally, to the smokebox front.

No. 4, fig. 3, shows a change from No. 3, in that the netting is placed both horizontally and on an angle, in order to present a greater surface of netting for the purpose of arresting sparks.

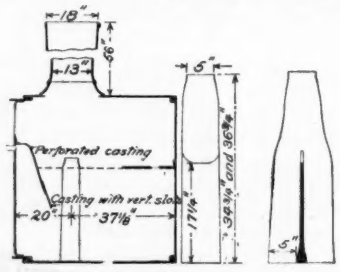


Fig. 2.

No. 4a, the same as fig. 3, except that the netting in this case is carried up from behind the exhaust nozzle to the top of the smokebox, in front of the steam pipes, which gives a greater surface of netting.

No. 4b is practically the same as Nos. 4 and 4a, except that the netting is carried over and bent around the receiver and intercepting valve of a compounding device. Arrangement shown in fig. 3 seems to be the most generally used.

In arrangement No. 5, fig. 4, the netting and baffle plates are arranged generally in the same manner as in

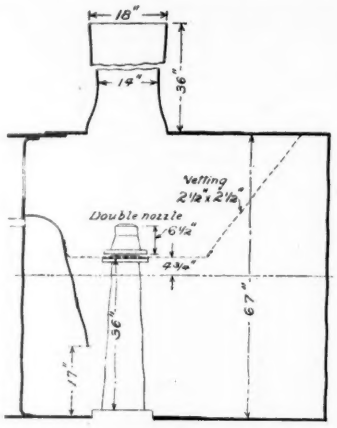


Fig. 3.

arrangement shown in fig. 3, the difference being the introduction of a sheet metal hopper surrounding the exhaust nozzle which is placed below the horizontal line of netting.

No. 5a is similar to 4a in arrangement of netting and baffle plate, the difference being in the introduction of a hopper and a shorter nozzle.

No. 6, fig. 5, is similar to No. 5, except that the hopper is made of wire netting, and the baffle plate is provided with a number of large openings opposite the upper rows of tubes.

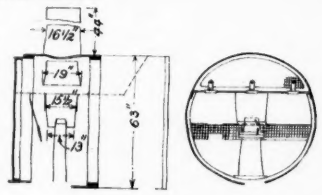


Fig. 4.

No. 7 is an adaptation of No. 5, in which the hopper is made of netting, and the baffle plate is brought forward to the center line of the exhaust nozzle and stack, except where it is

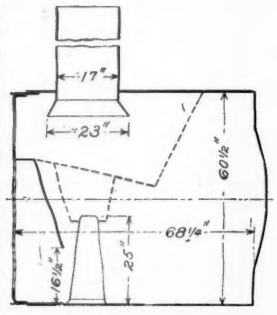


Fig. 5.

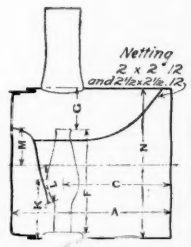


Fig. 6.

carried around behind the hopper to protect it from the direct action of the blast.

In arrangement No. 8, fig. 6, there is no distinctive difference from No. 4, yet it was deemed that there was a sufficient change from the ordinary practice to merit special consideration. In this case, the baffle plate is behind the blast nozzle, the netting starts from near the top of the nozzle and is carried forward to the top of the smokebox on a curve. This is the practice usual with the Brooks Locomotive Works.

No. 9 is an adaptation of the arrangement of netting in No. 4 and No. 8, and is given special consideration here because of the fact that the baffle plate is adjustable from the cab.

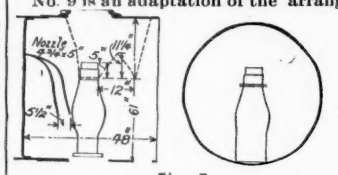


Fig. 7.

Arrangement No. 10, fig. 7, is a patent smokebox arrangement, known as "Snowden Bell's spark arrester," in which the netting is placed on an angle; is never laid flat, and there is a special arrangement of the baffle plate, made of two sheets of perforated metal.

Arrangement No. 11 is practically the same as No. 1, except that the baffle plate in this case is placed in front of the exhaust nozzle, the netting being placed horizontally.

Arrangement No. 12 is similar to No. 11, except that the netting is placed at an angle and extends to the top of the smokebox.

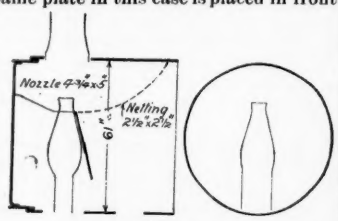


Fig. 8.

Arrangement No. 12a, fig. 8, is similar to No. 12, the difference being that the netting is curved to the top of the smokebox from the top of the nozzle.

In the arrrngement of the front ends of the historical engines we have presented to us some very curious combinations. For instance, in the "Lord of the Isles," which was built in 1850 and run until 1881, we see a very simple and unique design. A single and very long blast pipe is provided, placed in a very short smokebox having a stack perfectly straight and quite high, and in front of the tubes there is a series of parallel bars or angle irons, similar to our modern baffle plate, which practically cover the flue openings. The drawing of this engine, which was exhibited with it, shows that the engine at one time was provided with a variable exhaust. This was certainly one of the simplest forms of variable exhaust which we have, as it allowed of only two variations, the full opening, and the least opening, which was effected by means of a ring hinged at the back of the nozzle, that was dropped over the opening as shown.

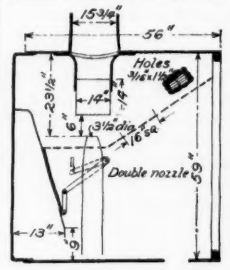


Fig. 9.

In the Philadelphia & Reading engine No. 694, which represents arrangement No. 1, we have a front end arrangement quite similar to that in use when the diamond stacks were in vogue. This engine, however, is provided with a perfectly straight stack. The petticoat pipe is adjustable, and with the exception of this petticoat pipe, there is nothing whatever inside of the front end to act as a spark arrester. This arrangement of the firebox is used in connection with a Wooten firebox. The Wooten box, as is well known, provides a large combustion chamber for the combustion of the gases before reaching the flues.

In the two German locomotives, we have the simplest combination of the more recent modern practice as regards the netting, nozzles, etc. In these engines, however, we see a marked peculiarity. It is usual in American practice to make the front end as large as possible and to keep it free from any interior arrangements that are not found necessary for assuring a good draft. In the two German engines besides having the short front ends, a single exhaust nozzle placed very close to the base of the stack, and a very simple arrangement of netting, there is placed in the sides of the smokebox a pair of curved plates extending horizontally from the flue sheet to the smokebox door. These plates rest on the bottom of the smokebox and are curved upward and slightly inward and then bent back against the sides near the top. Only that part of the flue sheet containing the flues is thus exposed in the smokebox, which contracts its capacity very much. The fireboxes of these German locomotives are perfectly plain, having no brick arches.

In the Winby four-cylinder express locomotive we have just the other extreme in the size and capacity of the smokebox. The arrangement of the netting is practically the same as in the German engines, and there is no baffle plate. The stack in this case being very short, owing to the extreme height of the boiler, is lengthened by means of a petticoat pipe which extends down into the smokebox to within 8 or 10 in. of the exhaust nozzle. This engine is provided with a new type of variable exhaust nozzle. This nozzle is provided with an annular ring, which is raised by means of a lever placed inside of and extending across the nozzle, below the tip as shown. This annular ring has three spokes, terminating in a spindle, which is guided by a socket supported by a spider placed within the pipe. In the full-open position, the area of the nozzle is equal to 30 sq. in., and when closed is equal to 21½ sq. in.

The arrangement of the front end in the London & Northwestern engine "Queen-Empress," as designed by Mr. Webb, is quite similar to that of the Winby engine just mentioned, as in this case the smokestack is carried down into the smokebox and provided with a flaring end, and is but a short distance above the exhaust nozzle. As is well known, the "Queen Empress" is provided with a combustion chamber, placed between the front and the firebox flue sheets. This chamber is 2 ft. 10 in. long, and provided with an ash hopper, which can be opened from the foot plate. The firebox is provided with a brick arch.

In the C., B. & Q. engine No. 550, built by the Rogers Co., and the N. Y., L. E. & W. engine No. 805, built by the Baldwin Co., we have two similar arrangements of the front end, in combination with two very dissimilar fireboxes. The C., B. & Q. has a Belpaire and the N. Y., L. E. & W. a Wooten firebox. Both engines are provided with taper stacks. We have here two very widely diverging proportions between the flue opening area and the area of the grate surface. The ratio between the flue opening area and the grate area in the case of the C., B. & Q. engine is 6.36, and in the case of the N. Y., L. E. & W. we have a ratio of 14.25, the flue opening in the C., B. & Q. engine being about two-thirds of that in the N. Y., L. E. & W. engine. The difference is due to the large grate area in this Wooten firebox.

Another smokebox is that of the M., St. P. & S. S. M., No. 402, which is a Rhode Island compound. A peculiarity in this design is the shape of the exhaust pipe. The center line of the nozzle is 8 in. forward of the exhaust port in the saddle. The baffle plate is adjustable, and arranged behind the nozzle, as indicated in the diagram. The brick arch is carried on water tubes, and the firebox is very long and narrow.

Arrangement No. 5, represents the practice of the Baltimore & Ohio road on the three classes of their engines exhibited in Chicago. The front end arrangement of these engines is worthy of notice, owing to the change from the ordinary practice. The dimensions, shape and arrangement of these parts are the result of a long series of experiments. This road was one of the earliest to inquire into the subject of draft and draft appliances. They took one of their old Winans engines, a camelback, mounted it on carriers in their Baltimore shop, and inaugurated tests for determining the proper form and arrangement of the front ends. What we see here is the results of those tests. The netting is placed 12¾ in. above the top of the nozzle, and the perforated iron hopper extends from the netting downwards and surrounds the nozzle. The bottom of this hopper is perfectly plain, having no perforations or openings. Just above this hopper, and 3 in. above the netting, there is a short petticoat pipe, which has a 19-in. opening at the base, a 15-in. opening at the top, and is 12 in. deep, which brings it within 3 in of the base of the stack. This straight cast iron stack is 16½ in. in diameter. Both single and double nozzles are used with this arrangement. The baffle plate is adjustable, and at its lowest position is 13¾ in. below the center of the boiler. It is interesting to note that the exhaust nozzle is on a line with the center line of the boiler.

Arrangement No. 7 is from an engine, No. 330, built for the Norfolk & Western by the Baldwin Locomotive Works. In this we are shown another departure from the usual arrangement of smokeboxes. As before mentioned, the baffle plate is placed vertically and on a line corresponding to the center line of the exhaust nozzle. As in the case of the B. & O. engines, just considered, we have a hopper surrounding the exhaust nozzle. The hopper itself is made of wire netting, of the same mesh as the other netting in the smokebox. The bottom of the hopper is a plate perforated with $\frac{3}{16}$-in. holes. The baffle plate, where it meets the hopper, is carried around and behind it, to protect it from the direct action of the cinders coming through the flues. The baffle plate is made adjustable, and its lowest position is 9½ in. below the centerline of the boiler, and about 3 in. below the top of the nozzle. A cinder pocket is provided for ejecting the sparks by means of steam or compressed air.

In the Central Railroad of New Jersey, engine No. 450, arrangement 6, fig. 5, we have a different arrangement than that shown in either the B. & O. or the Norfolk & Western engines. The netting in this case starts from the top of the baffle plate, and runs forward to the ring joining the smoke box with the extension front, and then is carried upward to the top of the extension front. This gives a very large area netting for this arresting of the sparks. The hopper is made of the same sized netting as that used for spark arrester, and its base is formed by the flange of the exhaust nozzle, to which it is bolted. The baffle plate is adjustable, and presents a feature not met with in any of the other engines considered. It is a punched plate, in which the metal is thrown out ½-in. for the two upper openings, and ¾ in. for the third and lower one.

As in the B. & O. engine, but differing slightly from it, there is provided a petticoat pipe, which in this case fits into the straight stack some 4 in. The diameter of the stack is 17⅞ in., and the diameter of the petticoat pipe is 16 in., leaving an annular opening of $\frac{7}{16}$ in. all around, which, however, is a little too small to be of any practical value.

The total length of the petticoat pipe is 11 in., and the flaring bottom 23 in. in diameter, and 5 in. deep. The exhaust nozzles are double, and 25½ in. high, which brings them within 28¾ in. of the base of the stack Under arrangement 5a we have but one engine, and that is the B. & O. S. W. No. 123, a ten-wheeled freight engine. The arrangement of the netting in this case is quite dissimilar from anything heretofore considered. Starting from just behind the base of the stack, the netting extends downwards and forwards until it meets the hopper surrounding the double exhanst nozzles, which is on the line with the center of the boiler. It is then carried forward horizontally a short distance and then upwards to the top of the smokebox. The baffle plate, as is usual, starts from just above the top row of flues and inclines downward and forward. In its lowest position, the adjustable plate is 17½ in. from the bottom of the smokebox, which uncovers the fourth row of tubes. Here we have in connection with this arrangement a taper stack, and a radial stay firebox, provided with a brick arch, 34 in. long.

Under the head of arrangement 8, fig. 6, we have five locomotives built by the Brooks Locomotive Works, which represent the practice on the Great Northern Railway, the engines being all marked "The Great Northern." Here we have a baffle plate extending from just above the top row of flues, some 8 in. forward from the flue sheet, and thence downward and forward until it is within 13 in. of the bottom of the smokebox and 14 to 15 in. from the tube sheet. A plate of sheet metal extends horizontally from the baffle plate to a point just back of the exhaust nozzle, where it is joined with a netting which is carried forward a short distance on a line parallel to the center line of the boiler, and is then curved upward with a radius of 36 in., until it meets the top of the smokebox at the front ring.

The Brooks engines, including consolidation, ten-wheeled passenger, mogul and six-wheeled switch engines, are equipped with this design, which shows that it can be used for any class of engines. It might be well to add here that the exhaust nozzles are in all cases single, and are tapered upward from the least diameters, which vary from 4¾ in. to 5¼ in.

The N. Y. C. & H. R. engine, No. 999, fig. 9, differs somewhat from the general arrangement of the other eight engines under this head, the main difference being the extension of the stack into the smokebox by means of a short carrying pipe, which is of a less diameter than the straight stack with which the engine is provided. The baffle plate is adjustable from the cab, as in arrangement 9. Another peculiarity in this engine to which attention should be called is the Buchanan water table.

Considering the firebox of the engine, it stands alone, and is dissimilar to any other engine exhibited in the Transportation Building. Engines equipped with this type of firebox are known to give good and satisfactory service. Engines so equipped have made the highest speed record, have hauled the fastest long-distance train ever run in America, and made time as per schedule for over six months. This is certainly a test of the value of this type of water table as it has supplied abundance of steam for the engine, under the severe daily service in which it was placed. The value of the draft appliances as a factor is a question that cannot be answered here. But it is fair to presume that it was an important factor in the maintenance of steam.

Arrangement No. 10, fig. 7, represents a type of smokebox patented by Mr. J. Snowden Bell. In this arrangement the deflector plate is double, and extends in a long bend from the tube sheet, just above the top row of tubes, to within 18½ in. of the bottom of the smokebox. The lower end is 15 in. from the tube sheet. Both sheets in the deflector have perforations ⅜-in. in diameter, pitched to 1 in., extending from the lower ends of the plates to a height of 16 in. Any sparks which may pass through these double plates are pretty thoroughly broken in the passage, and when finally thrown from the stack, they are practically a powder and will not carry fire and are therefore not dangerous for setting fires on the right of way. The wire netting is placed in such a way that only a portion of it just the width of the blast pipe is placed horizontally, the rest being placed at an angle from the horizontal, so that all sparks strike it at an angle and are broken up before passing through. Single nozzles are used, and a cast iron taper stack, the base of which is provided with a cored passage extending entirely around it, for the Barnes smoke consumer.

In arrangement No. 11, is represented the Canadian Pacific engine, No 625, a ten-wheeled express passenger locomotive. In this arrangement, we have the baffle plate placed in front of the exhaust nozzle and slightly inclined forward. The lower portion of the plate is adjustable, and its lowest position is 19¾ inches below the center line of boiler. The netting extends from the upper edge of the baffle plate to the inside surface of the front end ring, where it is joined by means of an angle iron to a plate resting against this ring. The smokebox door is provided with a supplementary plate, such as is used on firebox doors evidently, to prevent the excessive heating of the front end. This plate also reduces the size of the front end about 9 in. From a point on the flue sheet, just above the top row of tubes, to the juncture of the vertical baffle plate and netting the baffle plate is extended as shown, which prevents the gases from passing direct from the flues to the stack.

Arrangement 12a, fig. 8, is similar in most respects to No. 12, except that the netting is carried forward to the top of the smokebox on a curve with a radius of 36 in. The netting is provided with a man hole, 12 by 18 in., which can be removed when necessary to get at the nozzles of the pipe fittings above the netting.

It is interesting to note, in connection with the French locomotives, that in the one belonging to the Western Railway of France, the blast pipe is placed centrally, the exhaust is placed opposite the lower edge of the top row of flues, and that the opening of the nozzle is quite large, being 5½ in. The top of the nozzle is provided with a cored passage extending entirely around it, and opening into this passage is the blower pipe. A series of small holes about ¼ in. in diameter, or less, perhaps, are drilled vertically through into this passage. This arrangement is intended to supplant the usual type of blower pipe, and in its way is quite novel All of the engines, except the one just noted, have adjustable nozzles.

The information is also given that all French locomotives having shallow fireboxes have no brick arches, and that all engines with deep fireboxes have brick arches. In our American practice, in contra-distinction to the engine just mentioned, the locomotives follow no rule as regards the use of the brick arch. Individual practice and usage seem to govern in all cases.

Mr. Demoulin, who represented the French railways at the fair, states that the French practice of locomotive designing is quite similar to our own, that is, as regards the arrangement of the fireboxes, front ends, tubes, etc.

In looking over and comparing the data relating to these front ends and fireboxes, as shown in the table, it is noticeable that there is no fixed rules as regards the proportion the various parts should bear to each other. In one of the columns in the table there is shown the ratio existing between the grate area as expressed in square feet and the flue opening area expressed in the same terms. Immediately adjoining it is a column showing the length of the flues in inches. When taking into consideration these four factors, we find again that there is no fixed rule, nor does there seem to be any attempt whatever, even in engines of the same size, designed for the same class of service and to all intents and purposes the same, toward similarity in arrangement, size or any dimension of the parts under consideration. It looks more as if those who are responsible for the design were riding their hobbies in order to improve some poor design, either to gain efficiency of the engine or to experiment upon the hobby design. In all these experiments there appears to be a lack of systematic advancement. It seems as if the trouble had been in locomotive designing ever since the development of the locomotive became a study, to grope blindly and ineffectually at the subject of draft appliances. While the engines shown at the World's Fair are representatives of some types of engines that have given very good service, comparatively, on the roads for which they were built, yet no two engines, it is fair to presume, of those exhibited will give anything like the same results in service, in the cost of maintenance, or bringing it down to a point where it is best understood, the cost per mile per ton of freight and train hauled. Practice, and the careful tests that have been made in the past, bear out the truth of these statements.

A plain statement of the question at issue is that the arrangement of the fireboxes, front end appliances for the control of the draft, size of tubes and their length, and the boiler, taken into consideration with the sizes of cylinders, ought to be taken in hand by a special committee, whose knowledge of this subject would fit them for investigating the subject. That this question is receiving some attention is evidenced by the appointment of a committee by the Railway Master Mechanics' Association to consider and report upon the subject. So far, it is understood that little or nothing has been accomplished. The subject is so large that they hardly know how to commence their work or upon what lines to proceed. All authorities upon the subject have been given careful consideration, and in no case have the experiments fulfilled the claims of the authors.

That the proper arrangement has not yet been found is evidenced by the variations in the few engines here presented. One of them may be right, but all cannot be. There is a proper proportion existing between all the factors entering into the construction of a locomotive boiler.

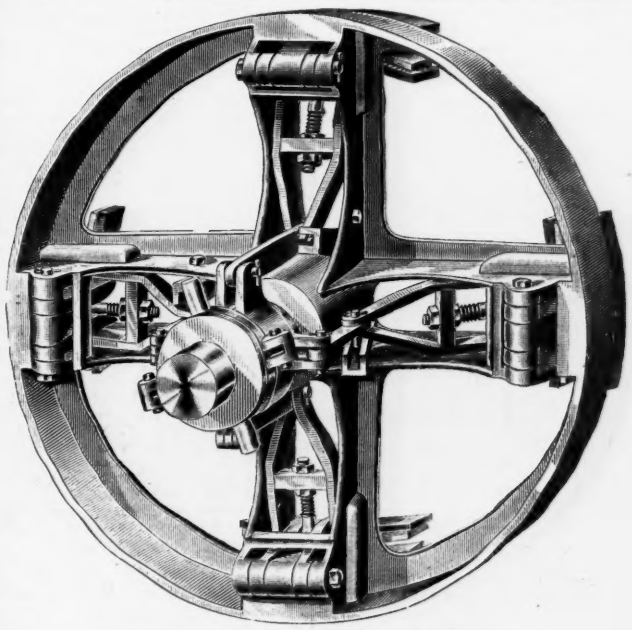
As it now stands, it appears that anything works, but how well or how poorly no one knows.

## The Ewart Clutch.

The type of clutch with wood-filled shoes which grip a pulley rim has been favorably known for some years. There have been certain difficulties, however, with many of them which the Ewart clutch, of which we give an illustration, has been designed to overcome. The four arms of the clutch are joined by a flanged rim which, when desired, can be so designed that the clutch may be used as a driving pulley thus making it possible to use this clutch where others could not be used. This rim greatly strengthens the clutch and also shields completely the levers and working parts.

The toggle is used to engage the gripping shoes. The links and levers which connect the toggles and operating lever are made of wrought iron in simple form and located very near the shaft, so that there are no heavy parts revolving at a distance from the shaft. The clutch is thrown in and out positively, and locked in either position. It is impossible for it to engage itself by centrifugal force. The clutch can be split just as an ordinary pulley. The only parts that need renewing are the wooden shoes, and the jaws grip with uniform pressure regardless of the thickness of these shoes.

The Ewart clutch was favorably received at the recent street car exhibition in Milwaukee. It has but recently been put on the market by the Link Belt Machinery Company, the manufacturers of the device, but it has been in use in the shops of the company for a year and has given such satisfaction that the company feels justified in guaranteeing its performance.



The Ewart Clutch.

## Construction and Inspection of Locomotive Boilers to Prevent Explosions.

(*Continued from p. 927.*)

The following is a synopsis of the discussion of this Paper at the November meeting of the New York Railroad Club. The paper itself and our editorial on the paper and discussion appeared in our last issue.

*Discussion on General Features of the Paper.**

*Note:* All of the rules for inspection given in the paper were taken from the printed instructions of five prominent railroad companies in this country. No important changes were made in the text.

Mr. MITCHELL (Erie): While I cannot agree in all particulars with Mr. Barnes' report, I think it is a very valuable one.

Mr. WORTHINGTON (Byer, Peacock & Co., Manchester, England): I have been very much interested in the remarks that have been made this evening. Not having had the opportunity of studying the paper, I do not feel quite able to criticise the opinions of Mr. Barnes in the way that some members have been doing. I think, the tendency being to make so many compound engines, and to carry 200 lbs. pressure instead of 120 or 140, it will become very necessary to look after the safety of our locomotive boilers.

Mr. JOUGHINS (Norfolk & Southern): Mr. President, I think that Mr. Barnes has given us a paper about which we can do a great deal of talking, anyway. I think that almost every sentence of his paper could be criticised, and most of it adversely. He, however, has put the matter before us in a way which makes the defects and weakness of boilers very prominent indeed, and has, I am sure, given occasion to a great many people to think about matters about which they had not thought before, in connection with boilers.

In describing the manner of boiler explosions, I think Mr. Barnes has used language which is a little unfortunate. The papers which are presented to such societies as this are expected to be educational in their effects, as well as to give us a chance of talking, and he does not very clearly express how boilers explode. At some places he practically says that the *whole of the water bursts into steam.* That is true only in a limited sense, and he should say so. I think it is wrong, when he has the knowledge, to put his statements in that way. There is also the question of hot crown-sheets. I do not quite understand what his illusion means in the paper to hot crown-sheets. I think it is well recognized that *hot crown-sheets, of themselves, are not a means of generating enough steam to explode a boiler.* They are merely a weakness which is there for the time. Sometimes it is a weakness so serious that the boiler will not stand the pressure. The red metal, of course, will not stand the same pressure as the cooler metal, the consequence being that the crown-sheet will come down. But further than that, I believe there is no reason for a boiler explosion due to a hot crown-sheet. I do not quite understand what Mr. Barnes meant in reference to it.

On the whole, of course, it is a very interesting paper, and one that will give us thought for many months to come.

[The paper distinctly states that 1 cu. ft. of water at a temperature corresponding to 180 lbs. steam pressure will make 240 cu. ft. of steam, while if it was meant that the whole of the water went into steam the volume would have been given as about 1,700 cu. ft. We cannot find in the paper any claim that a hot crown-sheet will generate steam enough to explode a boiler. That theory was proved false some years ago by U. S. government experiments.—EDS.)

Mr. MONTGOMERY: Practical men generally consider that boiler explosions are due to several causes: First

* The italics in this discussion are ours.—EDS.

insufficiency of strength in the shell; next, defective bracing or broken braces; again, from internal grooving; again, from heated crownsheets; again, from excessive pressure; again, from reckless management. Recently an engine was blown up on a Southern road. That engine was only six years old. From all accounts it might be assumed that the explosion or rupture took place from a seam or groove in the boiler. In other parts of the country men tell us that boilers can be run with perfect safety 25 years. This morning we had the flues out of an engine more than 20 years old; we took the standpipe out and *got a boy in the boiler to examine it*. The boiler, so far as *we* were able to see, was in perfect condition. [The italics are ours. The paper referred to inspections by boys and inexperienced persons.—Eds.] The Superintendent of Locomotives of the Pennsylvania Railroad said recently, in a published interview, that in 20 years they had only had two explosions, and I think the number of locomotives east of Pittsburgh is something like 2,000. That shows that the design and construction of their boilers is about as perfect as it is possible to make them. Explosions are not confined to one particular locality of the country. The percentage of boilers that explode is about the same in all parts of the country; it shows that the inspection is thorough and the design of the boilers is generally good. Mr. Dixon says they build just as good a boiler for a small road. A boiler is subjected to destroying effects and influences from the first day it goes into service.

*Discussion About Classification of Boilers.*

Mr. MITCHELL: About classification of boilers of the first class, Mr. Barnes says: "Each individual sheet must have been purchased under modern specifications with test strips attached to the sheets, and the analysis of the test strips, both chemical and physical, must be on record in the Master Mechanic's office." That being one of the conditions, the boiler would be first class; and yet, on the strength of that sheet producing these results, it is possible to have laminations which would practically throw the boiler from the first class into the second or third.

In paragraph *j*, he mentions, also, that stays should not be less than 1⅛ in. in diameter. I mentioned what the Southern Club had to say about that. He also mentions the shape of the thread. He also gives under that heading of first class that the back heads should have a lining plate of equal thickness with the head, and extending from flange at top to the third row of screw-stays of firebox, and with heavy T or angle-iron braces riveted through both plates. Very few boilers have that lining plate inside of them, and it seems to me that the back head can be sufficiently stayed by riveting on T-iron of sufficient strength and thus avoiding that double plate, although I do not object myself to the double plate.

On page 37 he throws all crown-bar boilers into the second class. Now, it seems to me that crown-bar boilers can be built so that they can go into the first class. In other words, nearly all the locomotives of this country, according to this paper, have second-class boilers. At paragraph *o* he speaks about oval pits not more than $\frac{1}{16}$ of an inch deep. It seems to me that if you had pits in the firebox sheet $\frac{3}{16}$ of an inch deep, that that boiler ought to go into the third class.

At paragraph *d*, page 38, I would infer that he throws all boilers without a lining on the back head into the third class. It seems to me that is improper.

He also says: "Staying generally inaccessible for quick and intelligent examination by an inspector with lamp and longhandle hammer." In old boilers there are more or less stays so located that you cannot get an examination of same by lamp and long handle hammer, especially those stays that are near the back boiler head, when they must be inspected from the dome. It seems to me that a great many stays in firstclass boilers are inaccessible.

Boilers over ten years old, he says in paragraph 8, should go into the third class. We all have boilers over ten years old that are, in my judgment, as good as when first built, especially the boilers running in good water districts, where boilers will run for three months without washing, and I then only show very little impurities. Such boilers should not be thrown into the third class until they are much older than ten years.

*Discussion About Inspection.*

Mr. MITCHELL (Erie): Mr Barnes makes a statement as follows: "But few, if any, of the rules for inspection give a clue to what is wanted from an examination, and only in rare cases are any definite instructions given about how to conduct the details of an inspection." I claim that the printed and verbal rules issued to our inspectors and the experience gained by inspectors in the constant inspection of boilers make them, as a rule, thoroughly competent to care for such boilers. It is impossible to print rules entering into all details of inspection. The education of inspectors depends more on their experience.

He says: "Generally, the inspectors are left to their own judgment, and bring men with a limited knowledge of boiler design," etc. I would say that as a rule, and we know that there are exceptions to all rules, inspectors are not men of limited knowledge, but men of experience in that special line of business. He says in the paragraph following: "By good inspection and proper construction all danger of boiler explosions can be avoided." He does not bring in any statement there about careless men. Careless men anywhere will produce disastrous results.

He gives some statements made by various inspectors. For instance, he says that one man states: "I am an inspector, but my instructions are so blind that I don't know where or when my duty is done, and when or for what I am responsible." It seems to me that inspector ought to be discharged.

He says: "(6) Special examinations of the staybolts of locomotives in service must be made once every week." (Standard Pennsylvania Railroad practice at the present time.—Ed.) That would require a large number of additional engines, and where careful inspections have been made continuously of certain types of boilers and broken stays found so seldom, I cannot see the necessity of testing those boilers once every week. It is not our practice. We test whenever we wash out, and that is every 15 to 30 days; 15 days we generally try to figure on doing it in.

He says that the inspection of stays in locomotive building shops is defective. I deny that. The inspector of stays in locomotive shops is very careful.

Mr. MONTGOMERY: This morning we had the flues out of an engine more than 20 years old. We took the standpipe out and got a *boy in the boiler to examine it*. The boiler, so far as *we* were able to see, was in perfect condition.

I think with regard to the construction of locomotives throughout this country by builders and by the railroads, whether built with crown-bars or radial stays, they are perfectly safe; and after a boiler is put in use, if it is inspected thoroughly, I think that is all that is necessary. It is a question to my mind whether it is practical to carry out Mr. Barnes' ideas of inspection, or whether it is necessary; I do not think it is.

Mr. DIXON (Rogers Loco. Co.): Several points that Mr. Mitchell has raised I also have noted, but it is unnecessary for me to speak on them now. Mr. Barnes said in one place that the majority of inspectors have a limited knowledge of boiler design, and also have a limited knowledge of inspection. I do not see what a knowledge of boiler design has to do with the subject of inspection. Every man who inspects a boiler certainly must know what a staybolt or brace is put in for, and whether they are in sound condition, and not whether they are properly designed in the first place.

Then, again, he says that it is quite necessary to send a trained inspector to the works when an engine is building. If a trained inspector, on behalf of the railroad company, is sent to a shop while the work is in progress, he is evidently sent there for one of two reasons: either to instruct them how to build the boiler, or else to keep a watch on them for fear that they should be dishonest and put in bad work. If he is sent there for the first reason, it seems to me that the railroad company is taking a good deal on itself to say that the inspector knows more about boiler construction than the builder. The builder has been building boilers for a large number of roads, and knows the experience of probably a hundred different Master Mechanics. It seems to me they should know infinitely more about boiler construction and design than the inspector. On the other hand, if he is sent to keep a watch on them, if the builder starts out to be dishonest, you may have a dozen inspectors there and he will get the best of you. In fact, the worst piece of work I ever knew to be done was done right under the nose of a trained inspector. Then if a trained inspector should be sent—how about the small roads, ordering only two or three engines at a time, who cannot afford to send an inspector? I do not suppose Mr. Barnes means to say that those small roads have bad boilers palmed off on them because they cannot send inspectors to look after the thing.

Mr. WEST: I think the New York Railroad Club ought to put itself on record as being opposed to this system of inspection that Mr. Barnes has outlined. I think it is entirely impracticable. I do not think there is a road in the country can stand it.

Mr. LEWIS (D., L. & W.): As to the inspection, I do not see how any railroad can comply with the recommendations in Mr. Barnes' paper. There are some very good things here and a good deal of instruction, but as for the examination recommended, we haven't enough locomotives to do it, and I do not know of anybody else who has at the present day.

Mr. JOUGHINS (Norfolk & Southern): So far as the rules laid down for inspecting boilers are concerned, I do not at all agree with them. Some of those rules laid down for the second class of boilers are very good, because they are the experience of men who have been testing boilers for years. But the rules laid down for the inspection of a first-class boiler are, I think, very faulty indeed from beginning to end, and it would be impossible to carry them out on the majority of our railroads.

Mr. GRADY (Foreman Boiler Maker D. & H.): When a locomotive comes in, about once a year, we strip off the jacket and examine the firebox inside and out, and when she comes in for general repairs, about every other year, we take out the tubes and when we take them all out we take out the dry-pipe and have the bottom thoroughly scraped and look for cracks and pittings at the seams, etc., and see how our braces stand. Sometimes on the extreme corners at the front end of the firebox we find a broken brace or a broken stay. As a general thing we are not troubled much with broken braces. Staybolts, of course, we have had a great many of them broken before we commenced putting them in closer together.

Mr. BLACKALL (D. & H.): How did you find some of the staybolts that were drilled?

Mr. GRADY. Well, we never had any on our Division, but we did on the others. I found on taking out the first box that the bolts were broken and the holes closed up—a small hole about ⅛ in. or ¼ in. The bolts were separated from the sheet. I brought our Master Mechanic out and showed it to him. To all outward appearance, of course, they were all right, but when we came to examine them we found them broken.

Mr. BLACKALL: How do you test your staybolts?

Mr. GRADY: We have a man on the inside with a dolly-bar or sledge. I see by the paper that Mr. Barnes recommends hammering on the inside. You never find a broken staybolt on the inside. It is always on the outer sheet. By hammering on the outer sheet you are nearer to your fracture and surer to detect it.

Mr. BLACKALL: And holding the dolly on the outside of the sheet the scale on there would be apt to deaden the sound.

Mr. GRADY: The scale and rust and paint: on the inside, of course, the box is clean.

Mr. MITCHELL: Do you have water in the boiler when you test the staybolts?

Mr. GRADY: No, sir.

Mr. MITCHELL: Any steam pressure?

Mr. GRADY: No, sir.

Mr. WEST: I have brought down quite a number of staybolts that are broken from ½ to ⅝ through, and I would like to have some one explain to me how any one can determine from a hammer whether those staybolts were broken or not.

Mr. GRADY: I claim you can. You hold on the inside of that, and you will find that that will not sound the same as a solid staybolt. The hammer will not bound off the same. That bolt can be detected by hammering it.

*Discussion About Staying.*

Mr. MITCHELL (Erie): Mr. Barnes makes a statement which I would interpret to mean that the stays in the crown-sheet should not be beaded over—in other words, that the stiffness of the crown-sheet should depend entirely on the strength of the threads. He gives as a reason for that that less explosions occur than would otherwise if heads were used. I am inclined to think that in the center rows of crown-sheet stays they should have heads, in order to help stiffen the crown-sheet at that point, and again, as crown-sheets are only about ⅝ thick, we have a stronger resistance from the head of the bolt than we would from the thread, especially if the riveting-over at the bottom is not done in a perfect manner.

He makes the statement that stays are put in cold and frequently too slack to be of any real use until the crown-sheet has deflected more than it is safe to permit. I find in talking with men, that stays as a rule are placed in under light tension, and I know of only one or two shops where stays are put in loosely.

He says: "To put in this large number of stays so that they will draw properly is impossible" in a crown-bar boiler. I have never found any difficulty in having stays applied properly in crown-bar boilers. I think if the work is done by a careful man that it can be done as well there as in a screw-stayed boiler.

Then he says that it is possible with right an left take-ups to adjust all the stays in the boiler so that they will draw evenly. I do not see how they can do that. I would like to hear from the members on that point. He states that the only safe method of determining whether there are sufficient stays in a boiler is to make an accurate calculation on the plan followed by all of the best boiler builders. He does not state who the best boiler builders are, and it is hard to decide which is the best without a careful examination of the finished product. It seems to me he should have stated what factor of safety to use and let each one then make his own calculations.

(The paper reads "sufficient bracing to give a bursting pressure equal to at least five times the working pressure" -Eds.)

Mr. MONTGOMERY: In regard to holding the bolt in the crown-sheet, I should prefer to screw in the bolt and rivet it over. I think there is not sufficient strength there for a bolt not riveted to hold. There is more strain on the crown-sheet than any other part of the firebox.

Mr. GRADY: We put in the long stays from the boiler head tight—just as tight as we can get them. The same way with upright braces. In building a new boiler, we have a man take the distance every brace to $\frac{1}{32}$ of an inch, and then we put them in, numbering them 1 and 2, and so forth. We put them all on with lugs and pins. In case they do not fit exactly right, we have a pin swedged to $\frac{1}{16}$ or $\frac{1}{32}$ smaller than the others, to have an equal strain on all of them.

*Discussion about Staybolts.*

Mr. MITCHELL (Erie): Mr. Barnes says: "Staybolts should be put in so that the threads in the sheet do not indent the bolt. This is done by removing the top of the threads in the sheet. Preferably the bottoms of the threads of the staybolts should be round and not sharp."

That differs entirely from the results reached by the Southern and Southwestern Railroad Club, in which, after a series of experiments, they demonstrated that the United States standard thread was the best form of tap to be used in cutting these threads, and so far as my experience goes, I think that the United States standard tap is all right for staybolt taps.

He makes the statement: "If the stays were larger in diameter, there would be fewer broken ones. Probably the introduction of 1¼-in. screw stays, in the way he describes, would remove almost completely the prevailing troubles with screw stays. One of his illustrations was taken from a scrap pile, in which there were some parts of a steamboat boiler made with ¼ sheets and 1⅜ in. screw stays. The stays, being stiffer than the sheets, they did not break, but the sheets bent, and around each stay, near the top of the furnace, there was a ring of grooving.

Now, which is the best practice—to let the staybolts break or have the sheets buckle and cause that groove? The Southern and Southwestern Railroad Club decided that a ⅞ or 1⅛ stay was better, and would stand more vibration than a 1¼ stay.

He states that the largest *percentage* of breakages occurs on the back head and throat sheet. That is contrary to my experience.

He says: "It is not necessary to remove other staybolts around a broken one if the bolts are put in as called for in the requirements of a boiler of the first class." I would like to know why. It seems to me that if we had a broken staybolt I would want to remove those around it to be sure that none of them were cracked or unduly strained.

He gives as the practice of various roads, and he evidents concurs in it, that "in replacing a broken staybolt, the next staybolt in front and back in the same horizontal row, and the one directly above and below the broken bolt, must also be replaced." In a previous paragraph he said it was not necessary.

He says that the inspection of stays in locomotive building shops is defective. I deny that. The inspection of stays in locomotive shops is very careful. As to staybolt iron, I think you will find the experience of the country is that the softest iron is not invariably chosen for staybolts. With a great many a hard iron is chosen in preference to soft.

As to telltale holes in the staybolts, I think the assertion that no solid screw staybolt should be put in a boiler without the telltale hole is going too far. There are some cases where a telltale hole, though an excellent thing in its way, is an element of danger. Suppose a staybolt, where the water is bad, starts to break; incrustation will fill it up and the hole will be so effectively plugged that nothing will come out of it.

He says: "Screw stays are made by contract, the holes in the boiler are tapped by contract, and the bolts are put in and riveted up for a fixed price per bolt, and the inspection of stays by locomotive builders themselves is very limited. All this goes to show, not the evil of contract work, which of itself is necessary in order to bring the cost within reasonable limit," etc. Now, I have noticed where boilers are built by contract, competent inspectors are placed over the work, and as a rule boilers built by piece work in reputable shops are properly inspected, and I cannot see why a boiler cannot be as good made by piece work as made by day work.

Mr. WEST: We have quite a number of hollow staybolts, and we have yet to find the first broken one

Mr. WORTHINGTON (Beyer, Peacock & Co., Manchester, England): With regard to the drilling of stays, it is not a universal practice, but it is an increasing practice in England. It is curious to notice in some parts of Europe, where the drilling of stays has been carried to an extreme. There was a case in which one of the French railroads got out a specification and asked for tenders for locomotives. I dare say you are aware that in England we are not often able to make locomotives for France. But they were very anxious to get these locomotives made in England, and a certain firm of locomotive builders in England got the contract to build them. But there was one little thing they did not like about it. These staybolts—it was a Belpaire firebox, by the way—these staybolts were marked to be drilled from end to end. The makers thought it would be all right just to drill them a little way in. But when it came to carry it out, these staybolts, 3 or 4 ft. long, had to be drilled all the way through. The French inspectors were obdurate. They would not allow them to drill simply 6 in. at each end, but they must have them drilled right through, and the difference between making that a paying and making it a losing job lay just there, and this poor firm had to drill every long stay in this Belpaire firebox from end to end. (Laughter.) That, no doubt, was very unnecessary. They had to be made just like a rifle barrel.

Mr. WEST: I take it that was a trained inspector.

Mr. WORTHINGTON: That was, no doubt, one of the very scientific inspectors.

Mr. MONTGOMERY: At the Saratoga meeting of the Master Mechanics' Association, Mr. Lauder, of the Old Colony road, said, in speaking of staybolts, that they had 51 boilers in use which had been built seven years, the oldest of them were about seven years old, and they had only found two broken staybolts in that time in that number of boilers. His theory was that their water was a very pure water for steaming purposes, *and that he put in a larger staybolt.* Mr. Vauclain, speaking at the same meeting on the same subject, said that they reduced the bolt down in the center and got better results by allowing it to vibrate. Mr. Lauder at the same time made the remark, I think, that they had fireboxes that had run 20 years and gave them no trouble. On the other hand, in the western part of the country fireboxes are taken out in two years. Mr. Barnes, in his paper, has fixed the life of a boiler at about 18 or 20 years. That would be a *very short limit.* Mr. Barnes recommends heavy staybolts. On a locomotive that was assigned to the division with which I am connected, we had occasion to put in some new staybolts, and we found *a* staybolt 1⅝ in. in diameter that was broken. That being the case, it would be of very little use to make the staybolts large, and I think that the strength in the sheet would not be sufficient to hold such heavy staybolts. The result would be that you would have continual bending and working that would destroy your sheets. When we had the old, wood-burning engines they were hot and cold all the time, and we ran them for years and you hardly ever heard of a broken staybolt. But to-day we are finding them all the time, and I do not quite understand it.

*Discussion About Grooving, Pitting and Corrosion.*

Mr. LEWIS (D., L. & W.): I have had a little experience with boilers pitting and with furrowing above the mudring; and using the same kind of water and in the same service there are engines of the same class that give no trouble. In about three years we have to cut a piece out and put a new piece in; other engines doing the same service are running 10 and 12 years without trouble. Some experts have tried to make me believe that it was the chemical action of the water—sulphuric acid in the water or something—but I cannot see it. Why doesn't it act on all of them? I claim it is in the material of the boilet. The engines are of the same class and with the same kind of boiler and firebox.

We have had some boilers give out. One of tbem was a Rhode Island engine—where the barrel part of the boiler was put in two sheets with a row of rivets on top and a row on the bottom, as well as a row on each side, and it opened out and split and did not do any damage. It did not go off the track and it did not hurt anybody. We have had an experience the same as that related in the paper about failure alongside seams at back end. A piece came out the same, the paper shows. The sling-stays were put in a long row. A good many experts saw it, and not one could tell the cause of it. I supposed I knew the cause—the boiler maker put the sheet in the wrong way. The way I found that out was by cutting it in strips and taking a sledge and and breaking it.

Mr. WEST: I have brought down some stay-bolts that we had taken out, and also a section of a sheet of a locomotive firebox that had been in service less than three years, and I never had seen such a pitting as that. We had engines running in the same territory, with fireboxes twelve and fourteen years old, without a patch.

That engine was carrying 140 lbs. pressure. You will notice the pitting is all on the inside. That was on two engines of the same class, of which we have eleven. The other nine engines have no apparent injury to the same sheet, using the same water. These engines have been in service about three years.

Mr. GRADY (D. & H. Foreman Boilermaker): That has come from leakage, I think. There might be wet ashes or something accumulating on there. It might be near a corner.

Mr. WEST: No, that is right in the center of the sheet.

Mr. GRADY: It might be a leakage there.

Mr. WORTHINGTON: There is one little point brought up about pitting. I thought, perhaps, our experience on some of the larger English roads might bear somewhat on the subject here. It had been tried on some of the roads using steel boilers and copper fireboxes where pitting was found a good deal. They place a block of zinc in the boiler. This pitting was reduced, and for many years done away with. This lump of zinc, weighing perhaps ten or fifteen pounds, is placed in the barrel of the boiler, and in the course of 12 months or so aetually wastes away. It seems to indicate that the action is something of a galvanic nature, and the waste, instead of taking place galvanically upon the boiler, is transferred to the lump of zinc. That has been found to reduce the pitting in some cases. Whether it be the water or whether it be something in the steel is a matter for the chemists to find out. But I fancy from what one hears of the chemical analysis of different parts of ingots, that if there is a difference of many hundredths of a per cent. of some of the ingredients in the steel ingot, the same difference may take place in the different parts of the plate, and if there are bits of pure iron in the plate and the rest of it is well carbonized or is good steel, then probably the pure iron might be attacked by anything of an acid nature more readily than the steel itself.

Mr. JOUGHINS: One of the very important things which deteriorate a boiler has been mentioned by Mr. Worthington, and has not been mentioned by Mr. Barnes at all. (The paper contains considerable argument about this subject and eight cuts show examples.—Eds.). Boilers deteriorate in two ways, sometimes very rapidly; one way is by grooving, which we are acquainted with, although it is very difficult to follow up the cause of every groove. I have seen boilers made very perfectly indeed, and where double straps were used on every joint except the circumferential joint, and there a single strap is used; yet, because there was a large angle iron put on the end of the boiler to attach the smoke-arch plate to, as they do in English practice, the boiler seemed to make a fulcrum there, at that thick angle iron, and produced a groove from the water line down. There is the question of water, which I think should be considered in connection with every boiler. Some water will pit a boiler very badly. Other waters will not treat that same boiler in that way. Some waters will treat some of a set of boilers very badly by producing pitting, and would allow the other boilers of the same set, perhaps, to get along all right. The method of using zinc is of course a very old one. I think steamboat engineers have used it for a great many years.

Those who were at the Master Mechanics' Convention can remember that Mr. Fox spoke about that system, saying that they put it on steamboats to prevent pitting. I have had some experience with its use, and I think it is a very good thing, indeed, to put in boilers. A short time bofore I went to the railway on which I am now, they had a new engine, bought about three years previously, and they used it entirely in yard work, so that it had to use one sort of water and that water was brackish—very slightly indeed; and the consequence was that they had to renew the firebox in the boiler in about two and a half years. When I was told of that difficulty, I immediately tried zinc in the boiler and I find now that it has been running for about five years with very slight deterioration, using, so far as we know, the very same water. It is nearly two years ago that we put into service some pump-house boilers, and in one place the water is a little brackish. We were warned of that, but we did not take any steps to help ourselves. In the beginning of last winter we attached a large steam heating plant to the boiler, and during the whole winter, which was a very severe one up to about February, we had trouble with that boiler. Every week or so a telegram would come saying that another tube had burst in the boiler, which was really only ten months old, and a man would have to hurry down and put in another tube as quick as he could. When a tube was taken out, it was found there was a single hole eaten through the tube. That was all. The rest of the tube was as sound as when put in. After that had occurred a few times I had some zinc put in that boiler. They had one tube break out a week afterwards, and although the boiler has been in steam night and day ever since, not another tube has given out. We keep it well supplied with zinc. I can only attribute our immunity from trouble to the presence of that zinc.

We all know that every metal has a certain place in the galvanic scale. Of course, we know that zinc will eat away in the presence of copper very rapidly indeed, if there is an electric current used from each metal, and it seems to me that a great many steels and irons have little defects which are inappreciable to the chemist, or to the manufacturer, but, nevertheless, are there. There are also plates which are more or less positive or negative in there galvanic action compared with other plates, and those plates which are lower in the scale are certain to be eaten away, it seems to me, and if there are small spots of pure iron around they are certain to be first attacked. Last year I saw a firebox taken out of a locomotive boiler, and on the outside sheet, on the water side, there was a regular comb of metal dug away, as it were. The staybolt itself was not touched, but the iron was scooped out so that the remaining piece was only about $\frac{1}{16}$ of an inch thick. I could only attribute that to what I tried to explain now—that that sheet of iron was slightly different in quality to the staybolt, and that the salt water attacked the plate just as zinc is attacked in the galvanic battery.

Mr. FORNEY: It may be interesting to call attention to a theory that was developed some years ago, with reference to the causes for the apparently capricious corrosion that takes place in boilers. Some one here mentioned a boiler that ran under conditions the same as another, and one corroded, and the other did not. The water was the same, and the construction of the boiler was the same. Some years ago attention was called to the fact that if a piece of iron or a piece of metal was subjected to tension, and then exposed to a corrosive agent, that the corrosion would occur more rapidly than if the metal was not under a state of tension. This is verified, I think, by the rapid corrosion that sometimes takes place in the stays of boilers. Another circumstance is the corrosion of steam chests. You will find that that occurs in the corner of the steam chest where the steam pressure exerts an undue strain on the metal at that point, and the acid in the oil will attack the iron just in that particular place. I think that in some cases, perhaps, this corrosion in boilers could be accounted for by the fact that the metal where it occurs is in a state of tension, and that there is some corrosive substance in that water.

*Discussion about Fusible Plugs.*

Mr. MITCHELL: Mr. Barnes says: "All boilers, whether stationary or locomotive, shall have two fusible plugs located at the danger line for low water." That is practiced a great deal and there is a great difference of opinion on the point whether it is necessary or not. I would like to hear the opinion of the Club on that point.

Mr. WEST (N. Y., O. & W.): I have had some experience with the fusible plugs, and I think they are a detriment and dangerous to the crown sheet. On account of them engineers are often accused of having low water when they have plenty of water.

Mr. BLACKALL: That is our experience.

*Discussion About Hydraulic Testing.*

The paper reads: "A hydraulic or steam test somewhat above the normal pressure is of no value to determine the safety of a boiler. No boiler is safe to run that will not stand three or four times the normal pressure without rupture. . . . The principal use of a pressure test after inspection is to avoid delays resulting from leaking at the joints that have been opened during inspection."

MR. MITCHELL: Mr. Barnes says: "All new locomotive boilers must be tested with hot water at the pressure of 25 lbs. above the working pressure." He gives this as spinions complied from a mass of valuable correspondence. It appearing in the paper indicates that he approves of it. Otherwise he would have objected to it. Yet, in another part of this same paper he states that it is not necessary and should not be done—to place a hydraulic pressure above the working pressure, as it would overstrain the boiler.

Mr. JOUGHINS: I cannot at all agree with Mr. Barnes in respect to the value of the hydraulic test. I think that the hydraulic test on a boiler is very valuable. We al lknow that explosions have occurred, even in new boilers, where steam is used for the first time.

The Government requirements are that the hydraulic test shall be placed on the steamboat boilers once every year, and that the hydraulic test shall be 50 per cent. above the working steam pressure. I think they are very wise in requiring that test in that way. While it is very true that a hydraulic test does not tell you whether a boiler is really weak or not, yet it is a certain safeguard to a man who has seen a boiler tested 250 or 260 lbs. He cannot have the same fear of that boiler that he would have if he had not seen it tested at all, supposing he has to use it at 180 lbs. pressure. *The gist of what I want to say about hydraulic testing is, that a boiler may stand a high hydraulic test a good deal above the steam pressure, and yet that boiler may be defective.* I think this self-evident, because the sheets may be eaten away to very nearly the bursting point. But, I say, if that boiler is properly tested with hydraulic pressure, it may be used with steam—at least that day—without fear of any disaster. It may be used a whole week and it may be used for several months without any fear of disaster. Of course *the hydraulic test ought to be supplemented by the hammer test* and by attention to every part of the boiler so far as it possible to see.

Secretary HILL: There is a feeling amongst a large number of engineers in this country against using a hydraulic test, believing that it does damage to the boiler and that the boiler will suffer from it. I do not believe that a hydraulic test for a second or two, or a minute or two, amounts to very much. A very bad plate will often stand a hydraulic test for an instant. If we strain the material nearly to its elastic limit, or even to its elastic limit for a second or two, it may come back or partly back. But if you strain metal to its elastic limit or near its elastic limit for any length of time it will rebel. In Germany, as well as in this country, I believe, in testing the Pintsch gas reservoirs, they put on double the pressure it is intended to use and leave it on 24 hours. I do not know any reason why we should not put a hydraulic test on a boiler and leave it overnight.

Mr. ROGERS: *I do not believe a hydraulic test is worth a hill of beans unless there is a hammer test with it.* Mr. Joughins made one remark to the effect that he would like to know why Mr. Barnes did not say something as to why boilers exploded. I do not believe there is a man on earth who knows why boilers explode. I have been associated with four boiler explosions, two locomotives and two stationaries. Two of them had plenty of water in when they went up and two had not.

*Discussion About the Removal of Dome-Caps.*

Mr. MITCHELL (Erie): Mr. Barnes states, under head of inspection of first class: "Once every six months remove dome-cap, throttle and dry-pipe, and examine all stays that are above tube and crown-sheets by tapping and shaking them to see if loose or broken." I think we would have to purchase a good many more locomotives than we have to-day if we are going to remove the dome-cap and dry-pipe once in six months. I do not believe it is necessary in good water districts to remove a dry-pipe any oftener than when engines go into the shops for general repairs. In bad water districts generally the flues have to come out in six or eight months and at that time the dry-pipe can be removed.

He speaks about the method of making the tests and then states that braces must be examined after each test. That means that the dome-cap must be removed, which would cause the test to be much longer than it would otherwise be.

He says: "Dome-caps must be removed every three months and a careful examination made of the interior of the boiler, so far as practicable, without removing the tubes. In another place he states that braces must be examined after each test and that must be once a week."

Mr. HILL: It is rather uncertain whether Mr. Barnes wants the dome-cap taken off every week or every three months or every six months. But I have been figuring a little as to what taking them out every six months would involve. I wrote to a dozen of our biggest roads, those having the most locomotives, asking how much time it took and how much it cost to take off the dome-caps, take out the throttle and dry-pipe, and that necessitates taking out the steam pipes, getting them in and the engine back into service. I have detailed accounts from ten roads or so, and the cheapest one of them is $15 and something, and the highest is over $30. The average is about $20. Supposing the Union Pacific took off their dome caps every six months. They had one year ago 1,055 locomotives in service. This would mean 2,110 inspections of that character. At the average price of $20 such examinations would cost $42,200 per year. The average time was four days. It would take the engines out of service a total of 8,441 days a year. If this laying up was all done by one engine it would amount to 23 years and 45 days. (Laughter). That is, six months. Now, if we are going to do that every three months, it would take 46 years. If it is very week, heaven knows if the road would have any engines to use at all.

*Remarks of Mr. Worthington About Copper and Steel Fireboxes.*

All our fireboxes in England are made of copper, whereas all yours are of the much stronger, and, perhaps, less durable material—steel. But from what I have seen in the last few weeks in this country, I think that we shall have to come toward your practice rather than you should come toward copper practice for fireboxes. I have been astonished to hear of the length of time that steel fireboxes last. I have been specially looking out for the way you stay your steel fireboxes. It seems to me that with the very high pressures we are getting in locomotives now, up to 200 lbs., as I have heard, that the pitch of the firebox stays will have to be reduced; that the stays will have to be placed nearer to one another. Our practice, in the copper boxes, is to place them 4 in. apart. I have not found in the fireboxes in this country, so far as my small observation has gone, any stays pitched nearer than 4 in., and yet your firebox sides are ¼ in. thick. It seems to me, if we are going to those higher pressures, there is likely to be some little difficulty in the thin boxes when they get a little eroded or a little thinner, that the plates will begin to bulge. Of course I do not speak from experience in this matter, but I was wondering if any difficulty of that kind had occurred.

Again, as to whether the thread which only goes through a quarter of an inch of thickness is sufficient to hold the firebox. We, with copper fireboxes, have a great deal of trouble with the upper rows on the sides where the stays so frequently break, due probably, as we think, to the expansion of the copper firebox being greater than the expansion of the shell, and we sometimes place the stays a little nearer together there, and I have been rather pleased to notice that on some of the roads here the pitch of the stays in the upper shorter rods at the sides has been reduced; in fact, it has been reduced so much that instead of four spots there are five spots; if you will understand what I mean by that—between every four stays there has been a "fifth spot" put in. That, it seems to me, has been increasing too much. But there is a tendency to place the stays nearer together, especially in the upper part of the box where the greatest difficulty no doubt occurs, as it does with us.

## Transfer of Some Alley Elevated Cars and Locomotives.

The Metropolitan Elevated Railroad in Chicago has purchased 20 locomotives and 100 cars from the Alley elevated road. This was in accordance with the arrangement made when the Alley bought these cars before the opening of the World's Fair, it being agreed that the Metropolitan would take them off its hands when the World's Fair traffic was over.

## Schoen Patent Brakeshoes.

Herewith are cuts showing two patterns of brakeshoes manufactured by the Schoen Brake Shoe Company and which offer novel features. They are ot cast, but are of a very low carbon, mild steel, manufactured by an entirely new process and forged by hydraulic pressure. The company makes strong claims that they are the best and cheapest brakeshoes, and that fully 50 per cent of the cost of ordinary brakeshoes can be saved, besides considerable economy in labor and inspection by the adoption of this shoe; that this pressed steel shoe can be worn to less than half the thickness that a cast iron shoe can with much less danger of breaking and that it therefore gives more useful wearing ma-

Shoen Patent Brake-Shoe.

terial per pound of shoes purchased. The shoe is said to grip the wheel immediately when brought against it and the shoe does not need to become heated by contact with the wheels before it exerts its full retarding power. The shoe being elastic and tough, wears longer, requires less inspection and repairs, and less attention to brake levers and rods. In fact it is claimed by the company to practically render automatic slack adjusters unnecessary. It is further said that the wear of the wheels is less than with cast iron shoes and that the shoes being of forged material, the delays and annoyances due to breakage of shoes in fitting and driving the keys are obviated. No doubt so far as the strength is concerned the steel forged shoe is stronger and less liable to break than the cast iron shoe, and being pressed in dies it would be more accurate in dimensions and form.

In addition to the shoes shown the company makes one of the same kind for street cars.

## Train Accidents in the United States in November.

### COLLI IONS.

#### REAR.

2d, on New York, Chicago & St. Louis, near Silver Creek, N. Y., a passenger train ran into the rear of a preceding freight, wrecking the caboose and one freight car, which took fire and were burned up. The engineer and fireman of the passenger train jumped off and were injured. It is said that the flagman did not go back far enough.

2d, 9 a. m., on Philadelphia & Reading, at Nicetown (Philadelphia), a passenger train standing at the station was run into at the rear by a following passenger train, badly damaging the two rear cars. Several passengers were injured, two of them being burned by an overturned stove. There was a dense fog at the time, and the flagman of the leading train, who had gone back a short distance to put down torpedoes, was killed by the following train while he was crossing a bridge.

3d, 1 a. m., on Southern Pacific, near Beaumont, Tex., a freight train ran into the rear of a preceding freight, wrecking the caboose and 5 cars. A man in the caboose was killed and another injured. There was a dense fog at the time.

8th, 6 p. m., on Chicago, Rock & Island Pacific, at Seventy-first street, Chicago, a through passenger train ran into the rear of a preceding local passenger train, crushing the rear car. Twelve passengers were killed or fatally injured and over 20 less severely hurt. There was a dense fog at the time and the foremost train was about five or ten minutes late, thus falling back upon the time of the following train; and it appears that the flagman used neither torpedoes nor fusees although he had both. A large volume of steam escaped from the wrecked engine and some of the victims were scalded. It was said that the wreck took fire from a lamp in one of the cars, but the flames were soon extinguished.

9th, on Chicago Great Western, at Oak Park, Ill., a through passenger train ran into the rear of a preceding local passenger train, badly damaging three passenger cars. There were but few passengers in the train and only one was injured. There was a dense fog at the time.

9th, 7 a. m., on Chicago & South Side Rapid Transit, at Twenty-second street, Chicago, a passenger train just starting from the station was run into at the rear by a following passenger train. The passengers saw the approaching train in season to rush forward, and all escaped injuries. There was a dense fog at the time.

10th, 7 a. m., on Pittsburgh, Fort Wayne & Chicago, at Fort Wayne, Ind., westbound passenger train No. 5 ran over a misplaced switch and into some freight cars standing on the side track; 3 employes injured.

11th, on Chicago, Rock Island & Pacific, near Limon Junction, Col., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking several cars. A braken an was killed and the conductor injured.

11th, on Chicago & Erie, at Monterey, Ind., a freight train was run into at the rear by a preceding freight, wrecking the engine, caboose and several cars. A man in the caboose was killed and 2 trainmen were injured, There was a dense fog at the time.

11th, 2 a. m., on Pittsburgh & Lake Erie, near Coraopolis, Pa., a freight train ran into the rear of a preceding freight, wrecking the engine, caboose and 4 cars. A brakeman was injured. It is said that this brakeman who was injured neglected to go back.

11th, 5 a. m., on Texas & Pacific, near Cheneyville, La., a passenger train ran into the rear of a preceding freight, doing considerable damage. The Division Superintendent of the road was injured.

12th, 2 a. m., on Northern Pacific, near Barnes, Wash., passenger train No. 2 ran into the rear of a preceding freight, wrecking 4 freight cars which, with their contents, were burned up.

19th, on Pennsylvania road, near Newark, N. J., a freight train standing at a block signal was run into at the rear by a following freight, wrecking the engine and several cars. The engineer was pinned in the wreck and scalded to death, and the fireman and one brakeman were injured. It appears that the automatic block signal failed to go to danger behind the foremost train.

21st, on St. Louis & San Francisco, near Van Buren, Ark., a freight train ran over a misplaced switch and into some cars standing on the side track. Four men loading freight were killed.

23d, 3 a. m., on Evansville & Terre Haute, at Vincennes, Ind., a passenger train ran into the rear of a freight train standing in the yard, wrecking several cars. The mail car and contents and other parts of the wreck were burned up It is said that the flagman of the freight failed to signal the passenger train, and this flagman, who was in the caboose, was fatally injured.

23d, on Savannah, Florida & Western, near Manor, Ga., a passenger train ran over a misplaced switch and into some freight cars standing on the sidetrack, making a bad wreck. The conductor was injured.

27th, on Kansas City, Osceola & Southern, at Harrisonville, Mo., a freight train was run into at the rear by a following freight, wrecking the caboose and one car. A passenger who had just entered the caboose was killed.

And 25 others on 16 roads, involving 3 passenger and 37 freight and other trains.

#### BUTTING.

4th, 2 a. m., on Lehigh Valley, at Morgansville, N. Y., an eastbound freight train ran into the head of a westbound freight train standing on the eastbound track, wrecking both engines and several cars. The engineer of the eastbound train jumped off and fell under the wheels of a westbound train which was passing at the time and was killed.

5th, on Southern Pacific, near Salvia, Nev., butting collision of freight trains while running at full speed, wrecking fifteen cars. Two trainmen and four tramps were killed and two trainmen and a tramp injured. It is said that one of the trains disregarded a telegraphic order.

8th, on Detroit, Lansing & Northern, at Delta, Mich., butting collision between a freight and a work train, injuring several employes. There was a dense fog at the time and it is said that the engineer lost his bearings and passed a station without knowing it.

8th, on Illinois Central, near Normal, Ill., butting collision of freight trains, wrecking several cars; both engineers and both firemen injured. There was a dense fog at the time.

9th, 7 p. m., on Columbus, Hocking Valley & Toledo, near Rising Sun, O., butting collision between a passenger train and a freight, making a very bad wreck. Both engineers, one fireman and the express messenger were killed and the passenger conductor was injured. The freight train should have waited at the last preceding station for the passenger train. The conductor tried to stop the train as soon as he saw that the engineman intended to run by, but he was unsuccessful. It is said that the engineman s watch stopped. There was a dense fog at the time of the collision.

9th, on Chesapeake & Ohio, near Brooks, W. Va., butting collision of freight trains, making a very bad wreck. One engineman was killed. One of the trains had disregarded a telegraphic order.

10th, on Wabash road, near Jacksonville, Ill., butting collision of freight trains, making a bad wreck, which took fire from the engines and was mostly burned up. One of the trains had disregarded a telegraphic order.

10th, on Yazoo & Mississippi Valley, at Warrenton, Mass., butting collision of freight trains, wrecking both engines and 17 cars and killing a breakman. It is said thaa there was a mistake in telegraphic orders.

11th, 4 p. m., on Cleveland, Cincinnati, Chicago & St. Louis, near Lafayette, Ind., butting collision of freight trains, wrecking both engines and several cars and blocking the track of the Lake Erie & Western. Three trainmen were injured. It is said that a telegraphic order was misinterpreted by one of the trains.

20th, 1 a. m., on Western New York & Pennsylvania, at Arcade, N. Y., a northbound freight train standing at the station taking water was run into at the head by a southbound freight train, the crew of which, it is said, were asleep. The telegraph operator in the station, alarmed at the accident, jumped out through a window and in so doing upset a lamp and set fire to the building. The flames were soon extinguished, however.

24th, on Western New York & Pennsylvania, near Kea ing Summit, Pa., butting collision of freight trains; 1 fireman killed and 2 other trainmen injured.

27th, 11 p. m., on Lake Shore & Michigan Southern, at Conneaut, O., an eastbound freight train ran over a misplaced switch and into the head of a westbound freight train standing on the side track, making a bad wreck. The engines were overturned and 1 engineer and 1 fireman were scalded to death; 2 other trainmen were injured. The westbound train had been set off to clear the track for a passenger train and to do this a crossover track had to be used. The man who set up the crossover switches neglected to set up the switch leading to the side track, and about that time the light on the latter was blown out.

29th, on Western of Alabama, near Montgomery, Ala., butting collision of passenger trains, badly damaging 2 cars. Four passengers were injured.

And 2 others on 2 roads, involving 1 passenger train and 3 others.

#### CROSSING AND MISCELLANEOUS.

1st, on New York Central & Hudson River, at Batavia, N. Y., collision between a freight train running at considerable speed and a yard engine, derailing 3 cars. One trainman was injured.

3d, on Southern Pacific, at San Ardo., Cal., a pay car train ran into a freight train and the Paymaster was injured.

8th, on Louisville Southern, at Lawrenceburgh, Ky., a freight train collided with some cars of stone standing on a siding too near the main track, badly damaging the engine and wrecking several cars. The conductor was killed and the fireman injured.

10th, on International & Great Northern, near Kyle, Tex., a passenger train ran over a misplaced switch and collided with a freight train, badly damaging several cars. The passenger conductor was killed.

14th, 4 a. m., on Baltimore & Ohio, near Flemington, W. V., collision of freight trains, wrecking 10 cars and injuring 2 trainmen.

16th, 7 p. m., on Toledo, Ann Arbor & North Michigan, at Dundee, Mich., a freight train ran into the side of another train at the junction of the Cincinnati, Jackson & Mackinaw, wrecking 20 cars. A brakeman was injured.

17th, at Minerva, O., a passenger train of the Cleveland, Canton & Southern backed into the caboose of a work train of the Lake Erie, Alliance & Southern at the crossing of the two roads, injuring 6 employes, two of them fatally. The wreck took fire, but the flames were soon extinguished.

21st, on Missouri Pacific, at Tipton, Mo., a passenger train ran into a switching engine, doing considerable damage. Four employes were injured, two fatally.

24th, near Des Moines, Ia., collision between a passenger train of the Chicago, Rock Island & Pacific with a freight of the Chicago Great Western at the crossing of the two roads; 1 engineer and 1 baggageman injured.

26th, 2 a. m., in Perth Amboy, N. J., a Lehigh Valley freight train ran past a danger signal and upon the track of the Central of New Jersey at the crossing of the two roads and was struck by a freight train of the latter which was running at considerable speed. The Lehigh Valley engine was overturned and the engineer killed.

28th, on Lehigh Valley, at Sayre, Pa., a freight train which was running at considerable speed struck an engine which was already derailed, making a bad wreck. An engine standing near by which was in danger of being injured by the approaching freight was started by an employe, who, after doing so, jumped off. This engine ran some distance on the main track and collided with a freight train. One trainman was injured.

28th, 11 p. m., at South Wilkes-Barre, Pa., a freight train of the Lehigh Valley ran into a freight of the Central of New Jersey, at the crossing of the two roads, overturning one engine and several cars. It is said that the Lehigh Valley train ran onto the crossing while the signal stood at danger.

29th, on Illinois Central, at Jackson, Miss., a passenger train ran into a freight train standing on the main track, doing considerable damage. One trainman was injured by jumping.

29th, on Western of Alabama, near Ciletts, Ala., a passenger train going into a side track was struck by a passenger train moving in the opposite direction before it had cleared the main track, and 2 passengers were injured.

30th, on Chicago, Rock Island & Pacific, near Des Moines, Ia., a freight train ran into a yard engine, injuring 3 trainmen. There was a blinding snowstorm at the time.

And 19 others on 19 roads, involving 3 passenger and 30 freight and other trains.

### DERAILMENTS.

#### DEFECTS OF ROAD.

1st, on International & Great Northern, near Hearne, Tex., a passenger train was derailed at a defective switch and most of the cars ditched. Twelve passengers were injured.

7th, on Grand Rapids & Indiana, near Martin, Mich., a passenger train was derailed by spreading of rails and the whole of it went into the ditch. Two passengers were injured. The loose rails were on a bridge, and it appears that the sleepers had been burned so as to loosen the spikes.

8th, on Louisville Southern, near Tyrone, Ky., a freight train was derailed at a defective switch and the engine was overturned. The conductor was killed and the engineman and fireman injured.

15th, 6 p. m., on Central of Georgia, at Lafayette, Ala., a mixed train was derailed by a broken rail, and 10 freight cars, baggage car and 3 passenger cars were ditched. The mail and baggage car took fire and a negro passenger was burned to death. It is said that he was in the smoking car alone and was under the influence of liquor. Eight passengers and 2 trainmen were injured. It is said that the track was in bad condition.

30th, on Indiana & Illinois Southern, at Newton, Ill., 2 cars of a passenger train were derailed and overturned. Five passengers were injured. Press reports say that the derailment was the result of worn out rails and rotten ties, the track having been laid 13 years ago, and subsequently changed from narrow to standard gage.

And 9 others on 7 roads, involving 3 passenger and 6 freight and other trains.

#### DEFECTS OF EQUIPMENT.

7th, on Chesapeake, Ohio & Southwestern, near Covington, Tenn., a freight train was derailed by a drawbar which was pulled out and fell upon the track. A tramp was killed and a brakeman injured.

8th, on International & Great Northern, at Hutto, Tex., a passenger train was derailed by the breaking of an axle, and 7 cars fell down a high bank. The mail car took fire: but the flames were extinguished with water from a river close by. A large number of letters were burned up. Several passengers were burned up.

19th, 7 a m., on New York Central & Hudson River, at Batavia, N. Y., 5 cars in a freight train were derailed by the sudden stoppage of the train in consequence of the automatic setting of the brakes on 22 cars. All four main tracks were blocked.

21st, on Pennsylvania road, near Greenfield, Pa., a passenger car in a mixed train was derailed by a broken axle and fell down a bank. The car was overturned and took fire from coals which fell out of the stove. Of the 8 passengers in the car only one was badly injured, though all had considerable difficulty in getting out. The car was burned up.

20th, on Southern Pacific, near Beaumont, Tex., a circus train was wrecked by the breaking of an axle and several cars were ditched. Five circus men were injured.

27th, 4 a m., on Baltimore & Ohio, near Hyndman, Pa., a freight train was derailed by a broken axle and 15 cars were precipitated with the wrecked bridge to the creek below. The engineer and conductor were injured by jumping.

And 20 others on 13 roads, involving 4 passenger and 16 freight and other trains.

NEGLIGENCE IN OPERATING.

1st, on Brooklyn elevated road, at Myrtle avenue, Brooklyn, N. Y., the engine of an empty passenger train was derailed by the misplacement of a switch while the engine was passing over it. The engine fell off the structure on which it was running, but lodged against an adjoining track so that it did not fall to the street.

3d, on Central Vermont, near Townsend, Vt., a passenger train was derailed by a misplaced switch, and the engine fell down a bank. The engineer and fireman were injured.

4th, on Lake Erie & Western, at La Porte, Ind., the engine of a freight train was ditched at a derailing switch near the crossing of the Lake Shore & Michigan Southern road. It is claimed that the switch was thrown to the danger position when the freight engine was almost upon it.

7th, 11 p. m., on Wabash road, at Moberly, Mo., a passenger train was derailed by a misplaced switch. The fireman was killed and the engineer and several passengers injured.

12th, on Union Pacific, near Wallace, Idaho, a passenger train was derailed by a misplaced switch and 8 passengers injured.

22d, on Pittsburgh, McKeesport & Youghiogheny, near Scott Haven, Pa., a freight train was derailed by a misplaced switch, and fell down a bank. The fireman was injured.

23d, on Chicago & West Michigan, near Zeeland, Mich., a passenger train was derailed at a defective or unfastened switch, and the first three cars were overturned. The mail agent and 6 passengers were injured.

And 6 others on 6 roads, involving 3 passenger and 3 freight trains.

UNFORESEEN OBSTRUCTIONS.

1st, on East Tennessee, Virginia & Georgia, at York, Ala., a passenger train was derailed by running over a mule, and the engine and passenger car overturned. The fireman was killed.

5th, 1 a. m., on Illinois Central, near Ullin, Ill., a passenger train ran over a misplaced switch and into a side track, where it was derailed, the track being too light for a heavy engine. The baggage car was overturned. The fireman and two tramps were killed and the engineer and baggageman injured. It is said that the switch had been maliciously misplaced.

6th, on Chicago Great Western, near Des Moines, Ia., a freight train was derailed by running over a horse. The conductor was killed and engineer injured.

10th, on Louisville & Nashville, near Altamont, Ky., passenger train No. 24 was derailed and the engineer and fireman injured. It is said that a rail had been maliciously removed from the track.

14th, 11 p. m., on International & Great Northern, at Grand Lake, Tex., a freight train was derailed by spreading of rails and 15 cars ditched. It is said that the rails had been maliciously loosened.

A short time after a wrecking train which had been sent to clear up this wreck was derailed near the same place and several cars ditched. It is said that many spikes had been drawn.

22d, on Great Northern, near Bonner's Ferry, Idaho, a passenger train was derailed by a landslide and the engine fell down a bank. The engineer and fireman and four passengers were injured.

23d, on Kansas City, Memphis & Birmingham, near Carbon Hill, Ala., a freight train was derailed by running over a cow, and eleven cars were wrecked. The engineer was fatally scalded and the fireman and one tramp were killed and a brakeman and one tramp were injured.

24th, on Great Northern, near Leavenworth, Wash., a passenger train was derailed by a landslide and the engine fell down a bank. The engineer, fireman and express messenger were injured.

26th, on Southern Pacific, near San Francisco, Cal., a freight train drawn by two engines was derailed at a misplaced switch, wrecking both engines and six cars. One trainman was injured. It is said that the switch had been maliciously misplaced, the lamp being turned so as to indicate safety; and that two other switches near by were misplaced the same night.

27th, on Yazoo & Mississippi Valley, near Lutcher, La., a gravel train was derailed and wrecked by a sleeper which lay upon the track. The fireman was killed and 3 trainmen and the engineer were injured, the latter fatally. It is said that the obstruction had been maliciously placed upon the rails.

29th, on Louisville & Nashville, near Biloxi, Miss., a freight train was derailed by running over a cow and the engineer and two brakemen injured.

29th, on Barre Railroad, near Websterville, Vt., a passenger train was derailed by a misplaced switch and the cars and engine were badly damaged. It is said that the switch had been maliciously thrown.

And 10 others on 9 roads, involving 4 passenger and 6 freight and other trains.

UNEXPLAINED.

2d, on St. Louis, Keokuk & Northwestern, at Weaver, Ia., a passenger train was derailed and ditched and a tramp killed

2d, on Pennsylvania road, at Fifty-second street, Philadelphia, a car in a freight train which was being switched in the yard jumped the track and ran against the engine of a freight train passing on the main track. The engineer was killed and the fireman injured.

3d, on Ohio Southern, near St. Paris, O., a work train was derailed and badly wrecked. Five laborers were killed and 11 injured.

15th, on Baltimore & Ohio Southwestern, near Vincennes, Ind., a freight train was derailed and 17 cars wrecked. A brakeman was killed.

18th, on Denver & Rio Grande, at Twin Lakes, Col., a passenger train was derailed.

23d, on Rome, Watertown & Ogdensburgh, near Norwood, N. Y., a freight train was derailed and a brakeman injured.

26th, on Missouri, Kansas & Texas, near Red Rock, Tex., a mixed train was derailed; a brakeman was killed and 2 trainmen injured.

30th, on Merchant's Bridge Railroad, at St. Louis, Mo., a yard engine ran off the track and the engineer and fireman were badly scalded.

And 17 others on 15 roads, involving 2 passenger and 15 freight and other trains.

OTHER ACCIDENTS.

2d, on St. Louis, Iron Mountain & Southern, at St. Louis, Mo., the engine of a freight train was wrecked by the explosion of its boiler. Four trainmen were killed.

10th, on Boston & Maine, near Salem, Mass., a steam shovel in a freight train struck an overhead bridge and knocked off its bearings so that it fell upon the train, doing considerable damage. A brakeman was insured.

15th, 9 p. m., on Pennsylvania road, at Elizabeth, N. J., a freight train ascending a steep grade became stalled and a following passenger train coupled to it and pushed it ahead. On going over a summit the freight train broke apart and the forward portion ran away from the other. The passenger engineman then applied the brakes, but the momentum of the freight train was such that the platform of one of the passenger cars was pulled out.

15th, on Burlington & Missouri River, near Belvidere Neb., the engine of a freight train was damaged by the breaking of a parallel rod and the engineer was injured.

25th, on Lehigh Valley, near Burdett, N. Y., the locomotive of a freight train was wrecked by the explosion of its boiler. The fireman was killed and two other trainmen injured.

27th, on Duluth & Iron Range, near Clifton, Minn., the engine of a freight train was wrecked by the explosion of its boiler and the engineer injured.

30th, on Lehigh Valley, at Van Etten, N. Y., the engine of a freight train was damaged by the explosion of its boiler and 2 trainmen were injured.

A summary will be found in another column.

## Glass Oil Cup for Dynamos and General Engine Bearings.

The engraving shows Lunkenheimer's "Crown" index sight-feed glass oil cup. This cup is provided with an index device for regulating the flow of oil, and an indicator arm turning on the lid to mark the notch giving the desired feed. The feed can be instantly turned off and on by the index lever. When the index arm is closed the lever can be left to stand up out of the notch, thus acting as an indicator to show from a distance that the feed is shut off.

As is often the case where a number of cups require different feeds, especially before starting engine, when an extra amount of oil is wanted, this can easily be accomplished with the "Crown" without losing the original feed, by simply moving the indicator arm a few notches to the right, and when the established feed is again required it is only necessary to replace the arm in the index slide, which marks the established feed.

These cups are made of cast brass; and it is claimed that the oil will not leak out between the brass and the glass parts. They are made in eight sizes holding all the way from ⅝ to 18 ounces of oil. Besides the "Crown" the Lunkenheimer company makes seven other styles for various purposes.

## The Nicaragua Canal.

The Reorganization Committee of the Nicaragua Canal Construction Company has sent out to the stockholders a plan for a new company. It proposes that the new company shall be formed with a capital stock of $12,000,000, of which $6,000,000 is to be retained for the benefit of the treasury, and $6,000,000 is to be distributed to stockholders of the present company, in exchange for their old stock, or is to be sold for cash requirements and to protect and maintain the present plant and property of the company.

The new company will own all of the assets of the present company. It will have in its treasury stock of the Maritime Canal Company amounting to $14,876,750, and obligations for first mortgage bonds of the Maritime Canal Company amounting to $5,559,950. Six million dollars of its own full paid stock will be in its treasury, or will be held by trustees for the benefit of the company. For each 10 shares of the old stock deposited one share of new stock, par value $100, will be issued. Depositors electing to pay $350 per share upon deposited stock will receive one share of new stock for each two shares so deposited.

There has been an investment in actual cash and interest thereon of $4,451,568.64, and in securities issued for purchase of plant of $2,923,200, making a total of $7,374,768.64. The results of this investment are:

The concession from Nicaragua and Costa Rica and the charter from the United States.

A survey and definite location of the canal route with the extensive cross-sectioning and subterranean explorations with the diamond drill.

At San Juan del Norte (Greytown) 1,000 ft. of breakwater has been constructed.

There have been constructed at San Juan del Norte wharves and warehouses, with proper landing facilities, officers' quarters, hospitals, storehouses and workshops equipped with tools and machinery.

A valuable dredging plant, consisting of dredges, tugboats, lighters and launches, has been acquired.

The Pellas franchise and plant for exclusive navigation of the San Juan River and Lake Nicaragua have been purchased.

Nearly two miles of canal have been excavated to a depth of 17 ft. and to a width varying from 100 to 230 ft.

Eleven miles of railroad have been constructed along the line of the canal and equipped for construction work, and the location of the line has been completed.

Sixty miles of telegraph line has been built.

The canal line for a distance of 20 miles has been cleared.

The Nicaraguan Government has been paid for considerable tracts of land, to be expropriated by that Government from private owners for canal uses.

Explorations have been made of all the sites proposed for the location of the locks and of the large dams.

A new survey and estimate have been completed of the lesser canal, to connect Lakes Nicaragua and Managua.

Much detail work has been accomplished necessary to a successful issue of the enterprise.

The funded and floating indebtedness, as shown at the time of the receivership, amounts to $572,455.99, including some disputed items. Of this amount $225,000 is due to the Maritime Canal Company for money loaned the construction company. It has been agreed with the Maritime Canal Company that in case of reorganization under the plan proposed by the committee, this portion of the indebtedness may be liquidated by the surrender to the canal company of securities. The remainder of the floating indebtedness, $347,456, is in the form of judgments, labor claims, liabilities to general creditors, and loans, all of which must be paid, or the assets of the company will be sold summarily and the enterprise be sacrificed. While the New York assets of the company are under the protection of a receiver appointed by the Circuit Court of the United States, many valuable assets are in Nicaragua, beyond the jurisdiction of the receiver and subject to the hostile action of local creditors.

Depositors are asked to place their certificates with the Central Trust Company. The report is signed by John R. Bartlett, Smith M. Weed, Henry E. Howland Richard L. Edwards, John J. Emery, Wilhelmus Mynderse and E. K. Sibley.

## German Notes on Locomotives.

Mr. G. Lentz, the designer of the Lentz boiler, often mentioned in these columns recently, delivered a lecture before a German engineering society on locomotive design, which is reprinted in a recent issue of Austrian *Eisenbahn Zeitung*. Mr. Lentz said that the German and other Continental locomotives are modeled after both English and American designs, with the result that a mixture of the features of both is found in them, the practice of later years, however, following rather more closely the lines of English builders. But the inside cylinders and crank axles of the English engine have not found favor, at least not in Germany, where sharper curves are permitted than in England and where, therefore, numerous crank axle failures have led to the adoption of outside cylinders.

Compared with the English locomotive the American one does not commend itself in appearance to Mr. Lentz's tastes, there being, as he puts it, less beauty of design in its makeup, while in many cases it is embellished with flourishes and needless ornamentation which give it an unrestful air. The English builder, on the other hand, aims at the utmost simplicity, and turns out an engine solid and clean cut in appearance.

Next to the English engines in the order of merit, so far as appearance is concerned, Mr. Lentz places those of Belgian make in which inside cylinders largely prevail. Crank axle fractures, however, occur in large numbers with these, notwithstanding the fact that their design provides for an extra bearing for these axles.

One possible reason for the prevailing English features in many foreign locomotives may be found in the fast that foreign markets have, in past years, been largely supplied by English builders, and even at the present time Holland, India, Australian, China, Japan and South America figure largely as customers of English works. Russia at one time drew its supply of engines from other countries, but is now able to meet its requirements with home productions. Sweden and Norway, too, which formerly were dependent on English and German establishments, now have their own locomotive works. Italy, on the other hand, while proud of the outcome of its own shops, of which there are several, but of modest pretensions, must still look to German, Austrian and French builders for its motive power. Spain and Portugal get most of their locomotives from France, though a small number come from Germany and England. Germany, England, France and Belgium share in the Central and South American markets, but American builders are now making serious encroachments in these fields.

In the matter of locomotive fuels Mr. Lentz states that while formerly Russia used wood almost exclusively, the now prevailing fuel is English and south Russian anthracite and naphtha. Wood is largely used in South America, while in Belgium dust coal is extensively employed, notably on the state railroads. Bituminous coal is the prevailing fuel of Austraian locomotives, and in Australia native anthracite deposits are in successful competition with English coals.

## The Mesaba Iron Range.

More than 1,500,000 cu. yds. of earth are being removed this winter from over the ore body of Mesaba range steam shovel mines. The Mountain Iron mine is employing a force of 200 men, five large steam dredgers and 10 locomotives day and night, and will strip 500,000 yards before spring if the weather is not too severe. The Duluth, Missabe & Northern is putting in three miles of yard tracks and sidings at this mine. At the Biwabik 500 men are at work and about 250,000 yards are being stripped by hand. Contracts are about to be let by the Minnesota Iron Co. for extensive stripping at two mines bought by it lately, besides building several miles of railway and yards to and at the Iron King mine. There will be 300,000 yards of stripping at the Iron King.

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## EDITORIAL ANNOUNCEMENTS

**Contributions.**—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

**Advertisements.**—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Reports now in hand from 14 locomotive building works give the number of locomotives built in 1893 as 1,958. Returns for 1892 from 14 builders made the output for that year 2,026 locomotives. But the same companies did not report for both years, and the companies from which we have no figures in 1893 are the smallest builders. We can compare the production of 14 companies for the two years, including all the larger shops. These firms built 2,008 locomotives last year and 1,950 this year, a decrease of only 2½ per cent. On the whole this is a more favorable showing than was to be anticipated. Equipment builders are sure to be among the first of those industries, depending for support upon the needs of the railroads of the country, to suffer from a serious decrease in the income of the railroads The fluctuations in the output of individual firms for the two years are in some cases very considerable. Five companies have increased their output by 160 locomotives, but nearly all of this is to be credited to one firm. Six companies have decreased their output by 228 locomotives. This loss is pretty evenly distributed among the six companies, and it is a fair indication of the falling off in the locomotive builders' business *for the year*. But, as in the case of nearly all other industries, these manufacturers find the serious aspect of their annual statements in the fact that the closing months show a tremendous falling off from the earlier portion of the year; and 1892 was a poorer year than 1891. Aside from the recent large order given by the Atchison, and some foreign orders, there is very little work now in progress in the contract shops.

In 1892 the car builders did a little better, comparatively, than the locomotive works, but this year they have suffered a great decrease in their business. Forty-one companies reporting in 1893 built 50,082 freight cars and 1,980 passenger cars against 98,126 freight cars and 2,195 passenger cars built in 1892 by 49 companies. The returns for 1883 include all the important companies except one, which it is known has suffered from a greatly diminished business, at least as great in proportion as that shown in the general averages. Six companies not reported in the above figures for 1893 which built 4,417 freight cars last year, have had their works closed during the whole of the present year. Four other companies report that their shops have not been running since June. The Pullman and the Wagner shops have recently been reported as working almost entirely on repairs, and the degree of general depression is emphasized by the entire closing, for the first time, of the Wason shops at Brightwood, Mass., which are, we believe, the oldest car shops in the country. The fact that the falling off in new passenger cars built is not greater, is explained, of course, by the extra provision made early in the year by many roads for World's Fair traffic. This must have inevitably produced a shrinkage, which it was expected would extend throughout 1894, at least. The very large decrease in new freight cars is partly compensated by the constantly increasing percentage of cars of large capacity, in the stocks of all the important roads. The effect of this cannot be estimated with any accuracy, but it is important, especially on roads whose business is largely in carrying grain, hardwood lumber, coal and ore. The losses of the year have borne quite evenly on the shops as a whole. Eight companies increased their freight output by 276 cars and six companies built 205 more passenger cars in 1893 than in the previous year. Considering decreases, we find that 34 companies have fallen off in their output by 29,949 freight cars, and 11 companies have decreased their passenger output by 346 cars. Passenger cars were built in 1892 by 17 companies, but this year by only 14.

The Pennsylvania Railroad will shortly have all passenger cars equipped with the quick-action brake and the locomotives equipped with the automatic engineer's valve. The process of changing from plain automatic to the quick-action brake has been going on for some time. The large number of cars and engines to be changed has necessarily delayed the matter until the present time. This shows the way in which brake matters are drifting, namely, toward the most powerful quick-acting and efficient brake that can be obtained for passenger service. Perhaps this turn in brake matters is emphasized by the investigation now being made into the efficiency of reinforced brakes. The reinforced brake has been brought out to do better work and more powerful braking than can be obtained from a quick-acting brake. It is found that in face of danger the length of stop, even with the quick-acting brake, is so great as to result in accidents, more particularly collisions. The reinforced brake is an improvement on the quick-acting brake; it does not make the brake act quicker, it makes it more powerful during the first part of the application while the train is running at a high speed. The reinforcement comes during the early part of the application, and is reduced as the speed reduces, in order to prevent sliding the wheels. This reduction is also necessary in order that the maximum braking efficiency may be obtained, for the reason that if brakes were applied with the reinforced pressure at low speed the wheels would slide, and when the wheels do slide the retarding force is greatly decreased. There can be no doubt of the necessity of using quick-action brakes wherever possible and the reinforced brake for all high-speed trains; and it would appear, from present indications, that in the future it will be as necessary to use the reinforced quick-acting brake as an improvement on the plain quick-acting brake as it now is necessary to use the latter in the place of the plain automatic.

The phase of receiverships, through which the railroads of the country are now passing, will teach the employees some lessons as to their rights and duties that may be useful. At any rate some of them will get a new respect for the law and that is worth a good deal. Probably an important element in the Lehigh Valley strike was the fact that the Erie and the Reading are in the custody of the courts. The Erie men who protested against handling Lehigh freight were told that they must refuse at their own risk and settle with the Court. They very sensibly concluded to avoid that trouble. Now another side of a receivership come up. It appears that the employees of the Toledo, St. Louis & Kansas City have filed a petition in the United States Court asking the court to allow the employees "to obtain living wages" from the railroad company. Since the receiver has been appointed the wages of the men have been cut down, and suit is brought to compel the receiver to pay the employes what they ask. Instead of ordering a strike the men appeal to the United States Court. The court will be called upon to find out out whether the men are entitled to more wages or not. Doubtless the men are influenced in their action by the hope that the publicity of their complaint will be of incidental advantage to them whether they get more pay or not. It will be remembered that a Southern judge a few months ago set out to do great things for locomotive runners who were not satisfied with the treatment the receiver accorded them; but his friendliness was mostly talk, after all. When it came to actual business the judge dealt with the men the same as any sensible railroad manager would. Probably there is no question of the power of the court in a case of this kind; it is merely for the court to determine whether or not the market justifies higher wages, and whether or not the railroad can afford to pay them. It will be interesting to see whether a court has any more bowels than a corporation; whether a judge who is a lawyer knows more about the subject than a receiver who is a railroad man, and to see if any new theory of the basis of wages is developed.

Not much is heard nowadays from those railroad officers who defend their use of the time interval system by claiming that, in the way they use it, it is just as safe a method of keeping trains apart as the space interval system, if not safer. They never did set up this argument very boldly, or present it as their main point, but yet, as a sort of auxiliary support, it has given comfort to a good many managers who knew that they ought to adopt safer rules, but who had not the courage to follow the argument out to a logical conclusion. The main argument, of course, is that the space interval costs too much; and this was strikingly shown on the Lehigh Valley road during the recent strike. When the blunders of the new men began to produce so many collisions that there was a prospect not only of killing employes and scaring away passengers, but of destroying much valuable property, the announcement was suddenly made that the block system would be put in use; but in a few days thereafter the strike was settled, some of the old men came back and in a day or two the operation of the block system was discontinued. It is true that the probability of a direct profit from the abolition of the time interval was unusually clear in this case, for the number of costly collisions was large and seemed to be increasing, whereas generally it is necessary to include the money value of the confidence implanted in the public mind and of the relief from anxiety in the Superintendent's office, in order to show that the block system pays; but nevertheless the effect on the public mind was doubtless a factor in the decision, and we see how a railroad manager who has to scrimp at every available point feels unable to furnish any higher degree of safety than the traditions warrant. The space interval was adopted to provide against the errors of careless men; carelessness will cause rear collisions even with the old men back in their places, but the collisions will probably cost a good deal less than would the operation of the block system, and the cheaper alternative is chosen. But whatever the Lehigh Valley's experience may teach about cost or other elements, it has shown that the block system can be quickly put into use whenever one desires to do so. Providing electrical apparatus and the employment and assignment of new men may require a good deal of time, and it is certainly desirable to take time and provide for operating the block system in the best manner wherever that is possible but in an emergency the regular telegraph stations can block trains and the ordinary appliances will answer.

Last week the railroads in the hands of receivers were summed up as aggregating 33,195 miles, and $1,727,512,000 capital stock and funded debt. On Saturday the Atchison (and St. Louis & San Francisco) added to these melancholy totals 9,345 miles and $530,000,000 or $540,000,000 more of stock and bonds. It is impossible to tell from the annual report quite what the bonded debt of the entire system is. The effect on the stock market was not great, largely because the event had been discounted. in spite of the assurances of the President of the company, and partly, no doubt, because people had two days, Sunday and Christmas, to think the matter over and get themselves steadied. This last circumstance is to the credit of those who contrived to have the receivership announced late Saturday afternoon. On Monday, the 18th, the stock sold on the New York exchange at 19 and on Friday it touched 14. Tuesday of this week the lowest was 13 and the closing 13⅝. The highest point it has reached this year was 36½ in January, and the lowest 12⅛ in July. President Reinhart says that the floating debt is not greater than it was 18 months ago and gives the obligations as follows:

| | |
|---|---|
| Time notes and loans due Dec., 1893, to June, 1894 | $4,100,000 |
| Call notes and loans | 2,200,0 0 |
| Interest due Jan. 1 | 3,900,000 |
| | $10,200,000 |

The gross earnings of the entire system for the year to June 30, 1893, were $50,733,706, with an increase of 7 per cent. over 1892. The gross per mile increased $359.19, to $5,429.21. The net earnings were $16.065,538; increase 6 per cent., and increase per mile was $100.41, to $1,719.23. In 1892 the increase per mile over 1891 was $351.39 gross, and $213.35 net. While the mileage earnings were below the average for the whole country ($6,986 and $2,0 68) they were higher than the average for several of the great groups. The South Atlantic, the Gulf and Mississippi Valley and the Southwestern groups all showed smaller mileage earnings, gross and net, in 1892 than the Atchison in 1893. The Northwestern was smaller in gross, but somewhat larger in net. The earnings per mile showed an encouraging increase also; and under the sound and economi-

cal management inaugurated under Mr. Manvel and with the present skillful financial conduct of the affairs of the company there was great reason to hope that it would tide over this disastrous year without another revolution. In fairly prosperous times it probably would have done so. The failure cannot be laid to the door of the management which took control in the autumn of 1889. It is an inheritance from years of inordinate ambition, if nothing worse, which culminated in the folly of the Chicago line.

### Unjust Imprisonment of Trainmen.

The summary arrest of innocent persons in case of a collision is an outrage which is coming to be very common in this country. It is an abuse of power by policemen which should receive the careful attention of municipal officers who have the authority to correct it. The arrest of street car drivers when a careless person runs in front of his horses has long been put up with by people like New Yorkers who put their city government in the hands of thugs, but with the growth of large cities and the change in the railroad service by which enginemen, instead of being well-known citizens, have come to be regarded as common "laborers," this phase of police regulation has become noticeable in many places.

In New York an elevated road engineman is arrested if a drunken man tumbles off the platform and is run over. On this road not long ago a slight rear collision occurred and the conductor of the foremost train was promptly arrested, apparently for no other reason than that the engineman of the following train told a bystander that the blame was on the forward train. We cite this as a simple case, for any ordinary policeman ought to know enough to see that, under such circumstances, at least 99 out of a hundred enginemen would lay the blame on the other fellow at the outset, whether-or-no. The policeman could not be expected to know that the rules of the road placed the responsibility for guarding against collisions wholly upon the engineman, but this only illustrates how easily an outrage may occur under present methods of administering the law.

In the Colehour case, a butting collision due wholly to the train dispatcher's carelessness, the telegraph operator and both enginemen were arrested and taken to the South Chicago police station. At the Seventy-first street rear collision the Chicago police arrested the *fireman* of the *leading* train (probably they couldn't find the engineman). They might as reasonably have "pulled" a half dozen passengers. These cases are only samples of what has occurred in various cities; and even country constables are catching the idea that this is a good way to show their zeal in upholding the law.

We call attention to these facts, because it is exceedingly mortifying to any law-abiding person to even set foot in a prison as a prisoner. It is true that men wrongfully arrested are generally let off without much delay, but every minute's delay is a gross injustice in such cases. A prominent citizen, say a man of wealth or a lawyer, becomes at once a martyr if he is deprived of his liberty unfairly, even for a few hours; as, for instance, when he is denied full opportunity to get bail in a semi-civil suit. But an engine runner arrested for some other man's fault is in about the same situation. He is what is called "a respected citizen," and he has friends who will give bail for him when the circumstances are made clear; but unfortunately it is not always easy to make them clear to non-railroaders, and his friends are harder to get at; and so he suffers unreasonably. He can find no satisfaction in suing the policeman for false imprisonment, for the policeman is pretty sure to have no property.

A policeman can rightfully arrest an apparently respectable person without a warrant only when there is "probable cause" for believing him guilty of a crime. In cases like those mentioned it cannot be claimed that there is more than *possibly* a ground for arrest, and it would seem to be the duty of mayors and police commissioners to try to instruct their officers to make a more intelligent distinction, though we confess that the instructing process will probably be a hard one to carry out. But the principle that a man is to be presumed innocent until he is proved guilty is deep-rooted and far-reaching; and policemen, being officers of the state or the municipality, and not mere servants, are bound to keep themselves informed as to the extent of its applicability to the circumstances which they are likely to encounter in the performance of their duties. Knowing what policemen are, however, municipal officers who instruct policemen must recognize, if they consider the subject, a definite though delicate duty to impart such instructions on this point as will produce a scrupulous regard for the rights of innocent persons. A person against whom there is no presumption of guilt is to be accorded the benefit of any doubt, and the public rightly demands that every policeman be trained to skill in weighing doubts in cases like those we refer to.

Any mayor or other supervising officer can feel safe in authorizing policemen to use intelligent judgment in this matter, for there is practically no danger at all of letting guilty persons go uncaught. Judging by the number of convictions on final trial, it is safe to say that nearly or quite all the arrests of enginemen or trainmen for murder or manslaughter that have been made in this country have been unjust. The reason for this, which has often been stated in these columns, lies principally in the fact that, though the person arrested is often more or less to blame for the collision, his responsibility is seldom so clearly established as to secure his conviction of a crime against life. Either two or three other trainmen share the guilt and the jurymen are too tender hearted to punish the whole; or the directors of the road are blameworthy and the jurymen let off the accused because they sympathize with the poor trainman oppressed by the rich director, or the culpability of the individual is mitigated by the insufficiency of his instructions, for which he is not responsible.

Furthermore, even if the arrests that have been made during the past few years can be called just, there is no definite evidence that they have had any effect as a deterrent on other trainmen, and the public welfare would therefore suffer no detriment if no more were to be made. A short term of imprisonment, with the publicity of the arrest and all the attendant circumstances, ought to be sufficient to scare into carefulness every engineer or trainman, who hears of the arrest of an acquaintance or even of a person unknown to him, if carefulness is to be inculcated by such means; but in the absence of any indication that there is any efficacy in this means, the presumption is strong that the true remedy for this kind of misconduct is to be looked for in some other direction. eman who feels impelled to arrest a trainman may therefore reflect that (1) he is as likely as not to take the wrong man, and (2) that, even if he gets the one who is to blame, the court is likely to decide that the law prescribing fine or imprisonment does not apply to the case.

### Encased or Open Finish for Locomotives.

Not once, but many times, the past season it has been said that foreign locomotives, especially the English, have a neater and simpler appearance than ours. One writer before a German engineering society has said that English designers aim at the "utmost simplicity, and turn out an engine solid and clean cut in appearance." Such remarks indicate a lack of study of detail, and opinion based on external appearance.

To impress the casual observer with simplicity of design, even in the case of our most complicated duplex-bogie double-compound locomotives, it is only necessary to hang on a few sheet metal aprons and covers. To the observer of limited knowledge a smooth exterior indicates simple construction, but to the intelligent railroad man a locomotive is not simple because it is smooth and well covered up. He wants to know what is underneath the sheet-iron covers. The difference between the American and English locomotives in simplicity of design is all in favor of the American. In appearance, the English locomotive presents a continuity of coverings, smooth and plain; the American locomotive has almost no covers, and the machinery is exposed. The comparison is not unlike that between two clocks, one with the case on and the other with the case off. But with the locomotive the casings have no value either to protect the machinery from the weather, dust or mechanical injury or to facilitate repairs or cheapen construction. Here the engineer and the inspector must see at a glance the principal parts of the machinery, and reach them, if need be, with the utmost facility. The simple smooth coverings are an obstruction, and in case of a wreck or minor derailment they are always in the way, and obstruct quick repairs. The beauty of a locomotive, like the beauty of most things, is somewhat relative, and depends a good deal on fitness. Perhaps the exposed machinery of the locomotive, with its irregular contour and broken lines and surfaces, does not compare in beauty with the smooth surface of a passenger car, but this is largely a matter of education. Those who are instructed in the mechanics of things, and have developed an interest and curiosity about the movement of machinery, will probably always prefer to see the internal apparatus of a locomotive, just as some bridge engineers see beauty in parts that are placed on the theoretical lines of construction, even though the chords have a broken contour and the sky-line have an ugly kink. Educated observers of this class will find beauty in the American locomotive with its interesting mechanism exposed, and will see in the shrouded English locomotive a mass of sheet metal perhaps with irregular bumps and lobes placed without regard for symmetry, or perhaps with graceful lines that have no other purpose than grace. To make an encased locomotive appear adapted for its purpose there should be no projection on the casings, and the whole mass should be shaped like a bullet with a parabolic end. There would then be lines of beauty, and the mass would suggest a speed at least; and this notion seems to have caught the innocent buyers of 100-mile-an-hour-railroad stock. But to simply cover up interesting parts and beautiful mechanism with uninteresting flat sheets and camel-like humps is to gain an ugly exterior in lieu of an entertaining and attractive lot of objects.

From an operating standpoint there are many reasons why a locomotive should have as few shrouds and covers as possible. From a motive power standpoint every part that costs money to maintain or that delays repairs and inspection is a detriment. From an economical standpoint all the money that is put into shrouds is needed in other parts; and in no place is additional covering needed more than around the exterior of the boiler to prevent radiation, and around the cylinders and steam chest to prevent loss by condensation. Every master mechanic knows many places where he would like to put more money in his engines to make them more economical and efficient, and, given his choice, he would choose such improvements rather than smooth metal coverings. From experience here it is pretty evident that when the motive power is badly pushed, and when small economies are sought for, the metal sheeting and shrouds will not be used, mainly because they are an obstruction in practical work, beautiful as they are in the minds of some.

### November Accidents.

Our record of train accidents in November, given in this number, includes 92 collisions, 101 derailments and 7 other accidents, a total of 200 accidents, in which 71 persons were killed and 195 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

| COLLISIONS: | Rear. | But-ting. | Crossing and other. | Tot'l. |
|---|---|---|---|---|
| Trains breaking in two | 12 | 0 | 1 | 13 |
| Misplaced switch | 3 | 1 | 6 | 10 |
| Failure to give or observe signal. | 7 | 0 | 3 | 10 |
| Mistake in giving or understanding orders | 2 | 6 | 0 | 8 |
| Miscellaneous | 10 | 5 | 8 | 23 |
| Unexplained | 8 | 3 | 17 | 28 |
| Total | 42 | 15 | 35 | 92 |

| DERAILMENTS: | | | |
|---|---|---|---|
| Broken rail | 4 | Track repairers' neglect | 1 |
| Loose or spread rail | 4 | Failure to give or to observe signal | 3 |
| Defective switch | 5 | Animals on track | 10 |
| Bad track | 1 | Landslide | 3 |
| Broken wheel | 2 | Washout | 1 |
| Broken axle | 10 | Maliciously misplaced switch | 5 |
| Broken truck | 3 | Malicious obstruction | 4 |
| Fallen brakebeam | 1 | Unexplained | 25 |
| Broken car | 1 | | 101 |
| Failure of drawbar | 5 | | |
| Too quick application of brakes | 1 | | |
| Misplaced switch | 9 | | |

| OTHER ACCIDENTS: | |
|---|---|
| Boiler explosion | 4 |
| Broken side rod | 1 |
| Miscellaneous breakages of rolling stock | 1 |
| Other causes | 1 |
| | 7 |
| Total number of accidents | 200 |

A general classification shows:

| | Collisions. | Derailments. | Other acc'd'ts. | Total. | P.c. |
|---|---|---|---|---|---|
| Defects of road | 0 | 14 | 0 | 14 | 7 |
| Defects of equipment | 13 | 26 | 6 | 45 | 23 |
| Negligence in operating | 51 | 13 | 1 | 65 | 32 |
| Unforeseen obstructions | 0 | 23 | 0 | 23 | 12 |
| Unexplained | 28 | 25 | 0 | 53 | 26 |
| Total | 92 | 101 | 7 | 200 | 100 |

The number of trains involved is as follows:

| | Collisions. | Derailments. | Other acc'd'ts. | Total |
|---|---|---|---|---|
| Passenger | 31 | 35 | 0 | 66 |
| Freight and other | 137 | 67 | 7 | 211 |
| Total | 168 | 102 | 7 | 277 |

The casualties may be divided as follows:

| KILLED: | Collisions. | Derailments. | Other accidents. | Total. |
|---|---|---|---|---|
| Employes | 21 | 17 | 5 | 43 |
| Passengers | 14 | 0 | 0 | 14 |
| Others | 10 | 4 | 0 | 14 |
| Total | 45 | 21 | 5 | 71 |
| INJURED: | | | | |
| Employes | 50 | 51 | 7 | 108 |
| Passengers | 30 | 54 | 0 | 84 |
| Others | 2 | 1 | 0 | 3 |
| Total | 82 | 106 | 7 | 195 |

The casualties to passengers and employes, when divided according to classes of causes, appear as follows:

| | Pass. killed. | Pass. injured. | Emp. killed. | Emp. injured. |
|---|---|---|---|---|
| Defects of road | 1 | 25 | 2 | 6 |
| Defects of equipment | 0 | 8 | 5 | 10 |
| Negligence in operating | 13 | 47 | 22 | 56 |
| Unforeseen obstructions and maliciousness | 0 | 4 | 6 | 19 |
| Unexplained | 0 | 0 | 8 | 17 |
| Total | 14 | 84 | 43 | 108 |

Thirty-four accidents caused the death of one or more

persons each, and 44 caused injury but not death, leaving 122 (61 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with October of the previous five years shows:

| | 1893. | 1892. | 1891. | 1890. | 1889. | 1888. |
|---|---|---|---|---|---|---|
| Collisions | 92 | 106 | 112 | 111 | 75 | 71 |
| Derailments | 101 | 84 | 110 | 90 | 73 | 70 |
| Other accidents | 7 | 9 | 4 | 3 | 3 | 4 |
| Total " | 200 | 199 | 226 | 204 | 151 | 145 |
| Employes killed | 43 | 44 | 46 | 44 | 39 | 25 |
| Others " | 28 | 17 | 23 | 22 | 3 | 13 |
| Employes injured | 108 | 103 | 134 | 125 | 90 | 106 |
| Others " | 87 | 96 | 73 | 140 | 77 | 73 |
| Passenger trains involved | 66 | 75 | 71 | 76 | 50 | 51 |
| Average per day: | | | | | | |
| Accidents | 6.67 | 6.63 | 7.53 | 6.80 | 5.03 | 4.83 |
| Killed | 2.37 | 2.03 | 2.30 | 2.20 | 1.40 | 1.27 |
| Injured | 6.50 | 6.63 | 6.90 | 8.83 | 5.56 | 5.97 |
| Average per accident: | | | | | | |
| Killed | 0.355 | 0.365 | 0.305 | 0.323 | 0.278 | 0.262 |
| Injured | 0.975 | 1.000 | 0.916 | 1.299 | 1.106 | 1.233 |

The worst accident in November was the rear collision in Chicago on the 12th. It appears that the story in connection with this collision, about a fusee being thrown off the forward train and then being picked up by a boy, so that the following train was not signaled, was not true. A boy picked up a fusee the following day, but the connection of this incident with the collision seems to have been an invention of the brakeman or his friends. The officers of the road state that the brakeman used none of his appliances for signaling, and yet he has been in the service for years. To show that precautions against rear collisions are not neglected the statement is published that the Rock Island road uses 150 fusees a week between Chicago and Rock Island. The coroner's jury in the case of this collision recommended that the conductor, flagman and collector of the foremost train be held for manslaughter. It appears that the collector had been instructed to look after the brakeman, and did not do so. The verdict also censured the road for running trains too close together. This and other collisions in Chicago during the fog of Nov. 8 and 9 were reported in the *Railroad Gazette* of Nov. 17.

Of the other passengers killed in November one was in the caboose of a freight train and the other is said to have been intoxicated, which fact is stated, presumably, to explain why he did not get out of the burning car.

It will be noticed that there was one fatal rear collision due to the failure of an automatic block signal. The reports state that this signal stood at "all-clear" for several hours. This case illustrates the principle that automatic signals should not be depended upon to protect the rear of a train unless some person on the train knows, from his own observation, that the signal stands at danger immediately after the train passes it. On those roads which place automatic block signals two or three hundred feet within the block section this safeguard is supposed to be provided, as the engineman can see the signal move from clear to danger just before he reaches it. The Pennsylvania, however, locates the signals so that they go to danger after the engine passes them, the operation thus being in harmony with the usual manner of working hand-operated signals. Against the plan of fixing the signal so that the engineman can see it move there is the theoretical objection that the signal may go to danger just at that moment from some other cause than the entrance of the train, and the practical objection, developed in the investigation of a collision a year or two ago, that in a dense fog an engineman finding a signal at danger may assume that his wheels have caused it to go to that position, when in fact it has been so moved by a preceding train, and he should treat it as a danger signal. The Pennsylvania's practice obviates these objections; but to make it perfectly satisfactory the rear brakeman, or some person some distance back of the engine, should be required to see every signal that is passed. In the case of an empty engine or a very short train the operation of this rule might be attended with some difficulty, but that could be got over in some way and it should not be allowed to prevent the adoption of such a necessary rule.

The number of butting collisions due to mistakes in orders was large this month, and two of those collisions, those near Salvia, Nev., and near Rising Sun, O., were very bad ones. The despatcher who gave the orders at Salvia is said to have become insane. The Rising Sun case illustrates the fact that the conductor can not always act as a sure check on the engineman. As in the case of the Nichols (Mich.) collision in October there is room for an argument that the conductor, if giving special attention to the movement of the train, watching every switch or landmark, might have taken action toward stopping the train sooner than he did; but in cases of this kind precise evidence is generally unobtainable, and at best we must admit that there is always some chance that the engineman may run into danger in spite of the most vigilant care of the men on the rear portion of the train.

The derailment of a locomotive on the Brooklyn Elevated road on the 1st was one of the most startling accidents on an elevated road for some time. There have been slight collisions and derailments, now and then, on both the New York and Brooklyn elevated lines, but in this case the engine was partly overturned, and in fact fell part way toward the street, but caught on an adjoining structure.

Among the curious or otherwise interesting accidents of the month were those at Elizabeth, N. J., on the 14th, and at Grand Lake, Tex., on the 14th. A dispatch from Clinton, Mo., on the 20th reports that a freight train from Ladue to Clinton and one from Clinton to Ladue discovered each other when they were half-way between those stations and running at good speed; but the engines were reversed, the men jumped off, and the trains stopped about 50 ft. short of each other. From Denver it is reported that a conductor leaning out of a car to look for signals on a train standing on a side track was badly hurt by striking his head against the head of the conductor of the other train, who was also leaning out. Both men were knocked insensible.

The rear collision at Nicetown, Pa., on the 2d was attended by the unusual circumstance of a brakeman being run over and killed, on a bridge, by the train which he went back to flag.

This month's record is remarkable in containing a large number of accidents on one road, the Lehigh Valley. We have included only those cases of which clear accounts were published, but there evidently were some others which would come within our definition of "train" accident. Our totals include 11 on the Lehigh Valley after the date of the strike; and 13 others have been noted in December.

At Portland, Or., on the 1st an electric street car was run into an open drawbridge during a dense fog, about 6 o'clock in the morning, and seven passengers were drowned. In Chicago, on the 13th, a cable car ran against a manhole cover which had been displaced by a horse, and 14 passengers were injured. In Philadelphia, on the 6th, a collision of an electric and a cable car injured three persons, one probably fatally. In Salt Lake City, on the 26th, a locomotive wrecked a street car, injuring three passengers. At Oakland, Cal., and at Brooklyn, N. Y., electric cars ran into railroad trains at crossings.

At Moingona, Ia., on the 18th, five persons in a wagon were killed by a train at a crossing, and at Xenia, O., on the 22d, three young women walking on the track were killed at one stroke. Near Hazleton, Pa., on the 17th seven trackmen were injured, two fatally, by the breaking of a brake block on their hand car while descending a steep grade.

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In consequence of the anticipated heavy traffic on its Chicago suburban lines during the past summer the Illinois Central fenced in its tracks and put up exit and entrance turnstiles at each of its stations between Jackson Park and the Chicago city terminus. No objection was raised to the presence of the turnstiles until after the close of the World's Fair, when complaints began pouring in, incited apparently by the attitude of a certain daily paper, which, for reasons of its own, waged warfare upon what it calls "the deadly turnstile." The agitation resulted in the passage, in the City Council, of an ordinance directing the removal of the turnstiles, whereupon the railroad company applied to the Court for an injunction restraining the city from interfering with the property of the company. It is said that the Mayor signed the ordinance, though advised by the Corporation Counsel that it was defective, in order to have the matter settled by the courts. Later the road filed an amended bill to enjoin the city perpetually from interfering with its passenger business, claiming the right under its charter to regulate such details of transportation. It was set forth that tickets and fares could not be collected if passengers were allowed to rush into the trains without restraint, and it was further stated that before the adoption of the turnstile 40 per cent. of the collected fares was appropriated by the conductors. This incident would ordinarily be of only minor consequence, as it cannot be doubted that the court will approve the entirely reasonable regulation of the railroad; but it is worthy of note as a flagrant instance of the highway-robber methods so often used, by people who pose as "the public," in dealing with a railroad. So far as can be seen the complainers in this case have no grievance at all, except that they cannot enter the cars at their own convenience and pay when they please, which means that the great majority would come at the last moment and that many would pay no fare at all. To railroad officers it will seem to be of a piece with the injured innocence which conductors put on when they complain about the injustice of employing detectives to watch for thieves among honest men—as though the honest men would be injured by the operation. It cannot be that the newspaper referred to is working in behalf of conductors who wish to steal, and we must, therefore, conclude that the passengers who used to ride without paying have come to regard that privilege as one of their rights as citizens of a sovereign State. Our readers will remember a similar complaint recently made to the Railroad Commissioners in Missouri, when the Chicago & Alton tried to reduce the number of passengers riding free wrongfully. The Commissioners entertained that complaint, and evidently sympathized with it, but they last week rescinded the order which they had issued, requiring the road to remove the gates from the car platforms, the Attorney-General of the State advising them that they had exceeded their powers. It is humiliating to have to admit that fares cannot be collected without a loss of 40 per cent., and it is discreditable to many railroads that they put their patrons to inconvenience because it is easier to check dishonest employees in that way than to check them entirely by suitable discipline within the ranks; but neither the Illinois turnstiles nor the Missouri gates are open to this criticism. Both are required for the orderly conduct of business, without regard to the honesty or dishonesty of employes.

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## NEW PUBLICATIONS.

*Round the Works of Our Great Railways.* By Various Authors. Pages 232, with many illustrations. London: Edward Arnold, 37 Bedford street, Strand. Price 3s. 6d.

The authors who have worked together to produce this book represent the locomotive departments of the London & North Western, the Midland, the Great Northern, the North Eastern and the Great Eastern. The chapters on the Great Western, the Old Broad Gage Engines and Their Successors, and the North British Works, are by Mr. A. H. Malan and Mr. A. E. Lockyer. Naturally a volume made up in this way contains a good deal of reliable information, some of it detailed and compact, some general and diffuse, but all interesting. The scheme, as suggested by the title, has been to describe the locomotive and car works of the great English railroads, and incidentally to tell something of their locomotive equipment. The many illustrations are largely from photographs of characteristic engines.

Naturally the London & North Western takes the first place in the order of treatment, being the best advertised of the English railroads and the biggest in earnings, and only second in length of line worked. Although our readers must know pretty well what the characteristics of Crewe are, and what the work done there is, yet they will find this chapter useful as refreshing their memories.

One must be frequently struck in reading the chapter with the close resemblance in some particulars between Crewe and Altoona, both of which are railroad towns and nothing else, both of which have almost exactly the same population, and both of which have become famous as headquarters of railroad mechanical engineering in their respective countries. Crewe is distinctively a creation of the railroads. Sixty years ago its population was only 148 persons. July 4, 1837, the first train passed through this village on what was called then the Grand Junction Railway. That year the Manchester & Liverpool, the Manchester & Birmingham, the London & Birmingham and other lines were amalgamated. The new company was called the London & North Western and in August, 1842, the complete line so far as then constructed was opened to the public. In 1843, the Grand Junction works, which had been before that at Edge Hill, Liverpool, were transferred to Crewe, and then the development of the town began; but in 1853 the wagon department was removed to Earlestown, and in 1861 the carriage department went to Wolverton, and the Crewe works now are given up entirely to locomotives. In 1841 the population of Crewe was 203, now it is about 30,000. Over 7,000 men are employed in the works, and with the exception of two sewing factories employing female labor, there is no other source of employment in the place. One must be struck here with the close resemblance to the history and condition of Altoona. It is a singular fact that there have been but three heads of the Crewe establishment. Mr. F. Trevithick was the first Locomotive Superintendent. He was the son of the great Trevithick of the steam coach. He was succeeded in 1857 by Mr. Ramsbottom, who was followed in 1871 by Mr. F. W. Webb, the present Chief Mechanical Engineer and Locomotive Superintendent, who served his apprenticeship at Crewe and has been connected with the works 35 years.

There is one well-known particular in which Crewe is unique in the world so far as we know. Here everything that goes into the manufacture of locomotives, and much else, is made from the raw material. Bessemer and Siemens-Martin steel is made from the pig. The North Western is the only English railroad company rolling its own rails, and plates for boilers and frames and for Webb's patent steel sleeper are also made here. In fact, the brass boiler tubes and the copper plates for fireboxes are the only things brought into the Crewe works in the manufactured state. As we have before had occasion to say, all of the signal work of the London & North Western is done at Crewe, including the manufacture, from the pig, of the rods (not pipes), for ground connections. Here also are built cranes, stationary engines—electrical, hydraulic and marine—and an immense variety of other machinery. We have never believed that this could be an economical plan for a railroad. The chances are that cheaper, more intelligent and more progressive work will be done by specialists; but the policy of the London & North Western makes Crewe a wonderfully interesting place to visit. This chapter is written by Mr. C. J. Bowen Cooke, Assistant Running Superintendent Locomotive Department, and we regret extremely that a man who was in a position to give us so much *exact* information should have given so little.

The second chapter, on the Midland Works at Derby, is by Mr. Jones, Assistant Locomotive Superintendent, and is considerably more satisfactory than that on the North Western, for the technical reader at least. The company's headquarters are at Derby and there are the principal workshops, gas works, telegraph and signal works, general stores and the headquarter offices. The locomotive and carriage works now cover 166 acres, 36½ of which is under roof. The great bulk of the com-

pany's rolling stock is built and repaired at this place, Mr. S. W. Johnson being now the Locomotive Superintendent. Forty new engines are built in a year on the average, and from 750 to 800 undergo heavy repairs. The engines appear to need heavy repairs at the end of about two years. Boilers last 15 years; that is, they run frrom 35,000 to 50,000 miles. Here, as at Crewe, are messrooms for the men; one where smoking is allowed will seat 800 men, another where it is not allowed will seat 800 men also, and a third where religious services are held during breakfast will accommodate 400. The men supply their own provisions, which are cooked for them.

The standard types of engines used on the Midland are shown by half-tone engravings from photographs, and the principal dimensions are given. These include the single driver express type, which works the traffic from London to Leeds at 53½ miles an hour with a load of from 9 to 13 coaches. These engines have 7 ft. 6 in. drivers. Another express locomotive has four drivers coupled, 7 ft. in diameter, and makes 50 miles an hour with from 12 to 20 vehicles. This company has always been progressive, has done much to improve speeds and passenger service, and is now experimenting on hot water heating for passenger trains, and has eight trains fitted with electric lights running daily.

The chapter on the Great Northern Works at Doncaster is by Mr. A. J. Brickwell, of the Surveyors' Department. This road is noted for punctuality, high speed and good third-class accommodation and service. In 1893 it put on the third-class dining cars, of which we have given some account from time to time in the *Railroad Gazette*. The standard locomotives of this road are also described, with some particulars of dimensions and weights. This company has recently adopted Pintsch gas for lighting its trains, and has works at London, Doncaster, Leeds, Nottingham and Boston. The machinery at these works is all in duplicate, and they are reputed to be the best of their kind in the world. At stations where there are no works the gas is supplied from traveling tanks with a capacity of 240 cu. ft., which are hauled by passenger trains.

In the long-distance Scotch traffic, worked jointly by the Great Northern, the North Eastern and the North British, a good deal of improvement has been made which will gradually extend through the English passenger business. It was in the joint stock for working this traffic that the first third-class, corridor, lavatory carriages were brought out.

The chapter on the North Eastern is written by Mr. Wilson Worsdell, who gives a brief history of the organization of the road, as do most of the other chapters, mentioning the interesting fact that the oldest section of this railroad is the Stockton & Darlington, the oldest bit of railroad in the world, having been opened in 1825. The entire system comprises about 42 railroads. The headquarters of the locomotive department are at Gateshead, but there are other large works at Darlington and at York. At Gateshead commodious messrooms for the workmen have been established capable of seating about 1,100 men. Meals are cooked in gas ovens without charge, and every man's breakfast or dinner is numbered and put in his place just before the electric bell rings announcing in the various shops the approach of the meal hour.

This company also has adopted the Pintsch system, and has erected gas works at Newcastle, York and Hull capable of producing 24 million cu. ft. of gas a year. The North Eastern uses the Westinghouse air-brake also. At Darlington may be seen George Stephenson's engine "Locomotion," which was built for the Stockton & Darlington in 1825, which ran its first public trip Sept. 27, 1825, and its last June 4, 1846, when it made 7¾ miles in 25 minutes.

Mr. Worsdell describes briefly the locomotive equipment of the system, including especially the Worsdell and Von Borries compounds. It appears that altogether 47 compound express passenger engines have been built at Gateshead, and the company has also 212 compound freight engines, making 259 compound locomotives that it has built within six years.

The coal docks of this company are very extensive and important, handling as it does an enormous coal tonnage. At Tyne Dock is shipped yearly the largest quantity of coal handled at any single dock in the world. The water space extends over 55 acres, and in the past year 4,880 steamers and 1,572 sailing vessels were received into these docks. The company has shipped here 27,000 tons of coal in 24 hours, and 5,924,000 in the past year.

We have quoted enough from this book to give the reader a pretty good notion of how it is made and what it contains. Although it is a small and seemingly unimportant volume it is just one of those volumes that are rare and are particularly interesting to railroad men. Its one great fault is that it has been made too "popular."

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*Report of the Commissioner of Railroads* to the Secretary of Interior. Washington: Government Printing Office, 1893.

The report of Gen. Wade Hampton, Commissioner of Railroads, is dated Nov. 1 and is supposed to give the condition of things up to June 30. It is a good document to put on one's shelves for reference. It contains a statement of the authority, functions and duties of the Commisioner, whose jurisdiction extends over the railroad companies west of the line drawn through the confluence of the Mississippi and Missouri rivers, to which the United States have granted any loan, credit or subsidy. The Commissioner recommends that the President appoint a commission with full power to settle the indebtedness of the bond-aided Pacific railroads to the government, and regards it of the utmost importance that such action should be taken. He also renews the recommendation of his predecessor that the bond-aided roads transmit all accounts for transportation services rendered to the government through his bureau, and that all disallowances or differences be reported to the bureau before final payment, and that the bureau report to the Treasury Department what changes are required in the payment or disposal of amounts due. The fact seems to be that there is great confusion between the Post Office, War, Treasury and Interior departments as to payment to these railroads and that there are now millions of dollars of unsettled bills awaiting final action and that the companies are held out of a good deal of money that is due them.

The report gives about 85 pages to a description, historical and financial, of the various railroads which are supposed to be under the jurisdiction of the Commissioner. It contains an appendix of 25 pages, being a report by the Engineer of the Commission of the present physical condition of the Union Pacific, Kansas Pacific and Central Pacific, which appears to contain considerable minute information of very little value. Another appendix gives an index to the principal laws relating to the bond-aided and land grant railroads, and another contains a syllabus of Supreme Court decisions affecting these rules. There are tables showing amounts of bonds issued, interest paid, condition of sinking funds, statement of amounts due to the United States, and other statistical information of value to the student of the affairs of these roads.

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*Railway Engineering and Mechanics.*—The monthly journal which has been known heretofore as the *Railway Master Mechanic* will be published henceforth under the name given above. It is proposed to broaden the scope of the paper, while continuing to pay special attention to locomotives, cars and shops and to rolling stock material generally. We are promised, however, that more attention will be paid to safety appliances and to the uses of electricity. We are promised also that it will be "the paper *par excellence* for the busy railroad man," on account of the superior manner in which the information contained in it will be condensed. The paper will remain under the business management of Mr. E. N. Lewis.

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*Annual Report of the City Engineer* of the City of Providence, R. I., for the year 1893.

The chief value of this report is to water-works engineers and others interested in municipal water supply, and for such persons it must be valuable. It contains elaborate tables of rainfall by months for 60 years; also meteorological observations day by day for each month of 1892, in detail and summarized. The report is illustrated with some very pretty heliotypes from photographs of the harbor and of work in sewer construction. Mr. J. Herbert Shedd is the City Engineer.

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*The Traveling Engineers' Association.* Report of the proceedings of first Annual Convention.

The first volume issued by this Association has made its appearance and is a credit to the body of men it represents. The page is of the proposed standard size, 6 × 9 in. The report of the secretary shows an encouraging increase in membership, the number of members enrolled at the organization being 53, including five associate members, those joining subsequently and prior to September bringing the total up to 107, of which number 90 are active and 17 associate members. The treasurer's report shows a balance on hand of $289.

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*The Mason Regulator Co.*, of Boston, has made three additions to its engineering series. No. 4, Electricity for Engineers, will be valuable to engineers who have electrical machinery under their charge. It also gives the rules of the Underwriters' Union for the installation of electric plants; price, 50 cents, postpaid. No. 7, the Engineers' Log Book, for keeping an accurate and systematic record of the engine room, also sold at 50 cents. No. 8, the Chief Engineer's Record Book, for keeping a record of the mechanical plants of large factories, is sold at 75 cents.

## Railroad Matters in Chicago.

*Freight Traffic.*—The feature of the past week was the fairly liberal inward freight movement; the receipts of grain by the eleven leading lines for the fine business days ending Dec. 22, aggregated 3,946,000 tons, compared with 3,606,000 the corresponding time in 1892. The deliveries of other produce were also free. It is predicted, however, in some quarters, that traffic will decrease the fortnight just opening, as farmers are said to be disinclined to continue fall selling at current prices for grain.

General Manager Earling, of the Chicago, Milwaukee & St. Paul, said business was not up to anticipations. He thought farmers were holding back their crops hoping for higher prices. An officer of the Burlington system said they were handling more in-freight than a year ago, but he was inclined to think the present volume would not keep up the first half of January. At the Rock Island a more cheerful feeling was observed. General Manager St. John said "that although the traffic of his system was not up to the capacity of its equipments, the month's earnings promised to come close to the same time last year. That fresh orders for grain cars had materially increased the closing days of the week, and he expected to have a large business in that class of freight the coming fortnight." The other lines reported an irregular business, and general traffic rather poor. It was stated, however, that the Atchison, Topeka & Santa Fe was having an average winter business west of the Missouri, where the grain movement is shown to be surprisingly large considering the repeated statements of the officials of the Kansas Agricultural Bureau that the present year's harvest in that state was so poor that it would not supply the home consumption.

The volume of out-bound freight was only fair, the chief loss compared with a year ago being on lumber and heavy iron goods, both of which showed a marked decrease. Miscellaneous merchandise showed about the same as last year, while coal increased.

The following shows the deliveries of grain and flour at Chicago by each of the railroads mentioned during the week ending Dec. 22, and the corresponding week in 1892:

| | 1893. | | 1892. | |
|---|---|---|---|---|
| | Flour. | Grain. | Flour. | Grain. |
| | Bbls. | Bush. | Bbls. | Bush. |
| C. & N. W. | 16,122 | 886,000 | 28,845 | 833,000 |
| Ill. Cent. | 1,650 | 512,000 | 300 | 439,000 |
| C., R. I. & P. | 10 650 | 293,000 | 3,900 | 311,000 |
| C., B. & Q. | 6,370 | 1,064,000 | 12,322 | 882,000 |
| C. & Alton | 2,550 | 128,000 | 450 | 82,000 |
| C. & E. Ill. | 150 | 57,000 | 150 | 73,000 |
| C., M. & St. P. | 24,12 | 597,000 | 21,355 | 481,000 |
| Wabash | 750 | 81,000 | 2,400 | 66 000 |
| C. & G. W. | 18,866 | 123,000 | 17,087 | 212,000 |
| A., T. & S. Fe | ..... | 173,0 0 | 450 | 227,000 |
| L., N. A. & C. | ..... | 12.000 | ..... | ..... |
| Totals | 81,233 | 3,929,000 | 87,259 | 3,606,000 |

Although the above table shows a decrease in flour compared with the same week last year, the shrinkage was more than compensated by an increase in miscellaneous produce. The total gain after deducting the loss in flour being 2,406 tons. It is also known that the deliveries of through shipments by Chicago roads to Eastern lines at interior points were heavy.

*Passenger Traffic.*—There is no appreciable improvement in the passenger traffic. Even special holiday rates have failed to stimulate travel to any considerable extent. Through travel in all directions is of very moderate proportions, although some roads are hopeful of a moderate increase in Pacific Coast and Southern tourist business immediately after the opening of the New Year.

*Equipment and Track Materials.*—Aside from the 250 refrigerator cars being built at the Pullman shops for the Atchison, Topeka & Santa Fe, the writer is unable to learn of any new orders for rolling stock from the big Western lines. The managers, so far as seen, stated that they did not expect to be in the market to any extent the coming year, as they were already provided with more cars and locomotives than they had business for. A call at the office of the Illinois Steel Company also elicited the fact that, aside from 7,000 tons of rails allotted by the combination out of a big order recently placed by the Pennsylvania Railroad, they had no business on their books worth mentioning. The manager of one of the big Western lines, when asked what he expected to pay for rails, replied that they could be had for about $24 per ton, and he was in no hurry to buy even at that price, as he saw no reason to justify an advance the first half of the coming year, if at all within the twelve months. He expected, however, to put down very cheap rails when he was ready for them. The reported order for 26,000 tons to the Colorado Fuel & Iron Company by the Union Pacific was regarded with surprise. One party remarked that a line in receivers' hands can afford to be more prodigal than those struggling to avoid such calamity.

*Demurrage.*—A few weeks since a Chicago court decided that a railroad company was entitled to collect demurrage from a consignee who failed to unload cars within 48 hours after notice of their arrival. Since then similar decisions have been rendered at other points one being at Peoria and three at prominent receiving markets in Iowa. Despite such court rulings many consignees here and at other leading Western cities continue to refuse to either take their property within the limit or pay the demurrage. The railroad companies have now decided to act as a unit in notifying consignees that in future all cars must be unloaded within the legal limit of 48 hours or be subject to a demurrage charge. The fact of intervening Sundays, holidays or bad weather will in no case be accepted as an exemption, the courts having decided that they do not constitute a proper excuse for delay after the time allowed. The Chairman of the General Managers' Association also states that suit will at once be commenced against those who have not paid back demurrage where the latter has been demanded.

CHICAGO, Dec. 25.

## Locomotive Boilers and Their Attachments.*

MR. STEWART: Attachments to boilers are limited only by the size of the butt on which they are placed. With the increase of attachments to a boiler the factor of danger is largely increased to the men on the footboard, and in accidents, such as a collision or derail-

*Abstract of a paper by Mr. Orlando Stewart, and discussion at a meeting of the New England Railroad Club, Wednesday evening, Dec. 13.

ment, which may cause the engine to tip over, at such times they are sure to be broken off and the steam and hot water escape. Many devices have been patented to automatically close these openings when they are broken off, but their safety exists largely in the brain of the inventors. The manner of fastening adjustments to boilers does not differ materially. My practice for check valves has been to rivet a composition flange 1¼ in. thick and 7 in. diameter onto the side of the boiler, through which I drill a tap hole large enough for the required size of check. For injector throttles I use a composition stand, with a flange on the lower end, bolted to the top of the boiler with four ¾ in. bolts. Two sides of this are utilized for injector throttles, two sides for air-brake and blower throttles, and the top for steam gage. Other small attachments are screwed into the boiler in the most convenient place. Thus I make 1½ hole in the boiler, supply steam for both injectors, air-pump, blower and steam gage.

The locomotive boiler is about the worst form of boiler that is manufactured. Stationary boilers have no limitations imposed upon them, their heating surface and grate area are not limited; heaters may be used and better circulation of water in the boiler obtained. Dampers retarded the gases in their passage from the fire-box to the chimney, so that their heat may be absorbed by the water.

It is possible in a properly constructed stationary boiler to evaporate 11 lbs. of water to 1 lb. of fuel; whereas with the locomotive boiler 7 lbs. is considered a remarkable performance, with an average of about 4½ lbs.

The locomotive boiler is limited in its grate area. The frame or driving wheels limit the firebox in one direction, and the distance between wheel conters limits it in the other direction.

When a locomotive has 170 lbs. she is smart, but the trouble is she won't make it. One thing is tried and then another, all to no purpose, and finally the exhaust tip is resorted to, which burns from 15 to 20 per cent. more fuel.

Now there is a reason for this. If we go back 30 years we find a very large engine that weighed 25 tons. The boilers were 38 in. in diameter; firebox 34 to 36; 125 flues; frames the same width as now. There was no hang to the boiler; it was straight from the mud-ring to above the top of the crown bars, the firebox straight from the mud-ring to the crown sheet; water space 1½ in. The fuel was wood. These engines always had plenty of steam. About that time we began to increase the size of the locomotive boilers and cylinders, the frames remaining the same.

We now have a water space in our largest engines of f3½ in. sides and back and 4½ in. front, below the rames. At the overhang of the boiler above the frames, there is no pretense of making the firebox conform to the shape of the boiler, and there are boilers where the six or seven top rows of staybolts were 8 to 10 in. long. Can any boiler make steam freely with such a body of water around the firebox? I say no, and believe that this wide and uneven water space is the cause of the vast number of broken staybolts. In those little old boilers a broken staybolt was a thing almost unknown. I ran one engine that had 1½ in. water space on the Boston & Lowell Railroad seven years and had not one broken staybolt.

I believe in large locomotives, and we have in this country the largest and finest in the world. We must make them more economical in the use of fuel. This can be done by reducing the water space to 1½ in. on the sides and back, and 2½ in. on the front; and by putting in a circulating pipe to take the cooler water from the front of the boiler and deliver it close down to the mudring, thereby avoiding the downward current which the water has ordinarily. If the water in this space be kept at the same temperature there would be no broken staybolts. If we should reduce this space, and make the inside conform to the shape of the firetox, repairs on boilers would be reduced 50 per cent., and there would be a saving in fuel of at least 20 per cent. I am sure that increasing the width of the water space was a move in the wrong direction. The heat cannot penetrate through so large a body of water so as to keep it to the required temperature to generate steam freely. As we are limited in our grate area, a limit should be placed upon the body of water that surrounds the fire-box.

If the outside shell of the boiler conform to the size and shape of the firebox, the tubes will be nearer the sides of the boiler, and their efficiency in generating steam increased. It may be argued that 1½ in. of water will not be sufficient to withstand the intense heat of the firebox. This may be reason why the water space was made wider when coal took the place of wood as fuel. If so, the reason is not valid. The action of the heat upon the water is not to lift it, but to simply change it into steam, and the hotter the fire the more rapidly this change takes place, and the smaller the quantity the quicker it is done.

To illustrate this fact, take a steam fire engine. Cannel coal is used, which makes a much hotter fire than any coal used in locomotives; yet with the intense heat which it produces the water space in those boilers is but ⅝ in., and the boilers carry but 24 gallons of water when in working order.

In conclusion there are three points:

First. Save fuel by reducing the water space around the firebox.

Second. Make the outside shell of the boiler conform to the size and shape of the firebox.

Third. Provide a water circulation which will keep the water moving from the front end of the boiler to mudring or bottom of the firebox.

Mr. Smith, of the Boston Forge Co., said he had experimented a good deal with boilers for making steam for running steam hammers; had had difficulty in obtaining sufficient steam. In an upright, tubular boiler, built 28 years ago, he had a water space of 2.5 in., and in a later one 3 in., and a third one with 3 in. and 14-ft. tubes with ample steam space. He had much difficulty in keeping up steam. He built a fourth boiler with a space of 3.5 in., notwithstanding the boiler maker thought it was too much and that the staybolts would break. He found it worked better, gave more steam and steadier service. The last boiler he had built had a 5-in. water space, under protest of the makers, but he thinks that it makes as much steam as any two other boilers in the shop. It has been in constant use for about five years and not a staybolt has broken. He believes in having ample steam space. He heats his boilers with flame from furnaces; the coal that heats his iron makes his steam. The heat does not pass outside the boilers, only through 3.5-in. tubes. A good head of steam is required to work hammers lively, and with the last boiler he has never had a lack of steam.

Mr. Lauder differed with Mr. Stewart in every proposition that he had made. He differed thoroughly in regard to water space. If possible without restricting the grate area he would rather put in a 4 in. water space than three; he would not dare, with the high steam carried and the long furnace, to adopt an inch and a half water space. He doubted if water could be kept round the long, deep furnaces with that water space. He had little faith in water circulators, and had never felt their necessity. Boilers are built of high evaporative capacity and are forced to the uttermost, and they stand ten, fifteen, twenty, twenty-five years, with very little repairs. He believes a boiler will steam better and more regularly with a liberal water space than with a restricted one.

As to staybolts, his experience was that the shorter the staybolts the more broken ones, in all kinds of locomotive boilers. He narrows the top of the furnace to get a longer staybolt near the top, where breakages usually occur. A serious question of to-day is to get staybolts that will stand a reasonable time without breaking. The design of the boiler has more to do with that matter than any other thing.

Breaking of staybolts is avoided in two ways: One is by a longer staybolt, the less angular movement vertically when there are differences of temperature between the inside and outside plate, and with less movement the staybolt will stand more and have a much longer life than if made short. The other is, that by having a large water space the temperature of the two sheets is kept more alike than it could be with a restricted water space. A heavy body of water gives better results from fuel, it extracts more heat than could result from a restricted water space and poor circulation. We have such good results in this matter of staybolts in boilers of our own design, and of recent build, that I am through telling it to my Western friends, because they will not believe it. Now I will make a statement which can easily be verified, which is, that in the last ten years there have been built 75 boliers under my supervision and of my own design, and we have had just seven broken staybolts. They have been running from two months to eight years. The first boiler we built to carry a pressure of 175 to 180 lbs., and in that boiler we have had up to this time three broken staybolts.

I have seen boilers within two years that had every staybolt in the boiler taken out in less than two months after their delivery. The staybolts were not broken, but were cut too small, and did not fill the holes. A staybolt should have a good thread, the hole should be carefully threaded and the bolt should fill the hole. The less pounding done on the end of that staybolt the better. My iron for staybolts costs 6¼ cents in the bar. Locomotive builders pay 2½ to 3¾ for staybolts. In a recent boiler explosion there were 12 broken staybolts in one bunch, and every one was all closed over; and there were six or seven others in the immediate vicinity almost broken, and nine that had been put in new only one week before. Investigation showed that the boiler maker had tested these staybolts and found nine broken, and put in new ones, and failed to find the other 19, and the consequence was an explosion and three dead men. Tests for broken staybolts should be made by men who are thoroughly competent and who are trained in the art, and who will be honest in their tests. A man can discover some broken staybolts with the hammer test, if properly applied, if he can get at them; if improperly applied it is useless. If a staybolt is nearly broken, the hammer test will fail to detect it so long as any part remains sound. Where it is completely broken off a competent inspector ought to find it by the hammer test. For ten years no staybolts less than an inch in diameter have been put in by me, and to that fact is my success with staybolts largely due. but the design of the boiler has more to do with it than all other causes combined.

Mr. Butler described an experiment performed to show the motion of the firebox in the operation of getting up steam. At a pressure of 100 lbs. the crown sheet rose $\frac{5}{16}$ in.; above 100 lbs. it began to go back again, as the boiler began to be heated alike, and at 160 lbs. it went back to within $\frac{1}{16}$ in. of its original position. That would show what the conditions are to break staybolts. It would certainly seem that a long staybolt would stand more of that expansion and contraction up and down than a short one, because it would be more elastic. The water space should not be less than 3 in., nor as large as Mr. Lauder indicates. The hammering in of staybolts is wrong. A staybolt can be screwed to its place without a hammer blow being struck, and it is not necessary to wrench them in with a long wrench.

Mr. Lauder explained that on advocating the use of an inch staybolt he referred to boilers using good New England water. On some of the Western roads, where the water in two, three, or five years uses up the furnace, he might start with a smaller staybolt, because the outside shell of the boiler there will wear out several fireboxes. Each time the firebox is supplied with a new shell the staybolt holes have to be made a little larger. This necessitates frequent renewals of staybolts, which is an item they do not have to consider in New England, where a firebox runs for 20 years.

## TECHNICAL.

### Manufacturing and Business.

Thos. Carlin's Sons, of Allegheny, Pa., have just issued the December-January number of their little pamphlet entitled Machinery in Stock. This catalogue contains a complete list of standard and narrow gage locomotives, dump cars, portable hoisting engines, Worthington duplex and other pressure pumps, together with rolling mill and miscellaneous machinery, in which the firm are extensive dealers. The articles mentioned are for sale or hire. A copy of this catalogue will be mailed upon application to the company.

The site of the varnish and color works of Valentine & Co. occupies a full block in the Eastern District of Brooklyn, but early this year it became necessary to increase the storage capacity for varnish. The alterations have just been completed, and now the largest of the several tank rooms has a capacity of 145,000 gallons. Two other tank rooms have a capacity of 74,000 gallons, giving a total for these three rooms alone of 219,000 gallons; and this is exclusive of the varnish in the factory proper and stocks carried at the warehouses in Chicago, Boston and Paris, and in the hands of regular agents. The company is thus enabled to hold much larger stocks of varnish, for the purpose of ripening and maturing, than heretofore.

Application for a receiver for the Hicks Car Co. has been made to the Circuit Court in Chicago by Henry O'Hara, of St. Louis, who represents that he owns over 2,000 shares of preferred stock. The complaint says that the company is insolvent, and that its affairs have been mismanaged.

The Wickes Refrigerator & Car Co., The Rookery, Chicago, has recently opened new offices at No. 262 Dearborn street, on the ground floor of the Monadnock Block. This company is doing a large and increasing business in refrigerator and cold storage work, and the first of the year will have in operation 250 new Wickes refrigerator cars, which it proposes to lease on favorable terms to shippers, railroads and transportation companies. Mr. Walter H. Wickes is President of the company, and Mr. Edward F. Luce Manager of the Car Department.

The Penn Elevator & Engineering Company, of Bloomsburg, Pa., with a capital of $50,000, was chartered last week. The directors are George R. Stephens, John P. Casey, George E. Swank, Pierre Rouillat, Philadelphia, and Charles W. Hoffman, New York City. The plant is now being erected in Bloomsburg.

The Wheeler Rail Joint Co. has been chartered in New York to manufacture rail joints in New York City. The capital is $50,000. The directors are H. L. Terrell, S. F. Sullivan, A. A. Spendlove and L. M. Schwan, of New York City, and S. Wheeler, or Westport, Conn.

The John Abell Engine and Machine Works, Toronto, with a capital of $500,000, is applying to the Ontario Government for a charter to manufacture engines, machinery, vessels and bridges. The promoters of the enterprise are John Abell, Henry Abell, Alexander Williams, James McMillan and others.

A meeting of the creditors of the Berry & Orton Company will be held at the company's office, Twenty-third and Arch streets, Philadelphia, Pa., on Jan. 2 at 2 o'clock.

### Iron and Steel.

The McDonell Rolling Mill Co., of Toronto, with a capital of $195,000 is applying to the Ontario Government for a charter.

### New Stations and Shops.

The Louisville, New Albany & Chicago will, it is reported, shortly begin the erection of new shops at Lafayette, Ind., having decided to remove its plant to that city. The company will receive from the town the sum of $100,000.

The citizens of Lima, O., hope to secure the shops of the Ohio Southern for that town and are now endeavoring to raise $45,000 as a subsidy to the company.

The plant of the Northwestern Car and Machine Company, which failed recently at Oshkosh, Wis., is likely it is said, to be secured by the Chicago & Northwestern and operated as a car shop.

### Standards of the Master Car Builders' Association.

It has been made known by circulars and through the press that the Secretary of the Master Car Builders' Association has prepared a pamphlet giving the Standards and Recommended Practice of the Master Car Builders' Association, as adopted in 1893, and lithographed sheets illustrating these. There are 13 sheets, 30 × 38 in., which may be had from the Secretary at 25 cents each. The drawings are carefully dimensioned and many of them are full size. They are on paper from which blueprints may be made, it being about as transparent as tracing linen. They are sold at about the cost of production and must be of great value to Master Car Builders and Master Mechanics for reference. Address Mr. John W. Cloud, Secretary, The Rookery, Chicago, Ill.

### The $50,000 Prize for a Better Motive Power.

In last week's issue was mentioned the offer of a prize of $50,000 to any one who, before March 1, 1894, should submit a system of street propulsion superior or equal to the trolley or cable. An entry for this prize will be made by the Kinetic Power Co., of Chicago. This Company owns and controls the Angamar Motor, of which the *Railroad Gazette* contained an account (Sept. 8, p. 676), when it was tried on the Western Avenue tracks of the West Chicago Street Railway Co.

### A Mine and Tunnel Velocipede.

A novelty in the way of light cars designed for use in tunnels has come into service in Colorado and other mining districts. It is a four-wheeled velocipede operated with the feet on pedal cranks, and is designed to run on the narrow-gage tracks of mines and tunnels. It was first suggested by Mr. D. W. Brimton, Manager of the Cowenhoven Tunnel of Aspen, Col., who had one built at his company's shops to save the time required to walk the length of the tunnel to where operations were going on. As soon as it was put in service its utility and economy became so evident that the foreman, shift boss and timberman each had to have one. The invention has in the mean time been patented, and arrangements been made with the Sheffield Car Company, of Three Rivers, Mich., for its manufacture. The mine owners and managers in the vicinity of Aspen, Col., were quick to see its advantages, and the car is now in use in ten or more of the neighboring mines.

The car has been carefully designed and tested by two years of service. The frame is of iron and steel, the wheels have steel hubs, rolled steel flanges and wooden spokes, and the driving gear is machine cut. The crank shaft is hand forged and in brass journal boxes. The

seat is of the Garford pattern, of extra strength and adjustable to any height. The machine can be lifted from the track with one hand, leaving the other free to carry a light or tools. There is nothing in front of the rider, and if the car run into an obstruction the rider may maintain his equilibrium by running a few steps. The machines can be operated at from 10 to 12 miles an hour, and on first-class track at from 15 to 20 miles per hour.

**Track Elevation in Chicago.**

Since the Chicago & Western Indiana declared it impracticable to elevate its tracks according to the plans proposed by the city, little or nothing has been done about this question until last week, when Mr. Howard Ellers, Consulting Engineer to the Mayor, brought forward a plan for elevating the tracks of the Lake Shore and the Rock Island railroads, which run parallel from the Van Buren street station south to Sixty-first street. In this plan the elevation is to be commenced about 160 ft. north of Sixteenth street where there is a crossing with the St. Charles Air Line, it not being considered practical to elevate any north of this place on account of the large number of tracks laid in the yards, and also because numerous overhead bridges already provided render it unnecessary. From the St. Charles Air Line crossing, the tracks rise on an easy gradient to the maximum elevation of 10 ft. At Archer avenue the street must be depressed 4 ft. Each line again comes to the surface at its yards, the Lake Shore at Forty-third, and the Rock Island at Forty-seventh. After passing its yards the tracks are again elevated to 10 ft. and continue so to about Seventieth street.

**Elevated Railroads in Chicago.**

The Metropolitan West Side Elevated Railroad Company has now secured its entire right of way on the main line from Clinton street to West Forty-eighth street, and construction is well advanced on the western end of the line. It has been decided that the line east of the Chicago River shall be just north of the line originally laid out, and the suits heretofore filed against the property will consequently be dismissed. The new line extends from Fifth avenue to the river, 100 ft. south of Jackson street. This is of course the most expensive portion of the right of way, but no long delays are anticipated, and the erection of the bridge over the river will probably be commenced soon. The contest for the car barn property of the West Chicago Street Railroad Company at Throop street has ended in a verdict of $32,860. The company had made an offer of $40,000 in private settlement, which had been declined. The right of way on the north line will be secured as far as Kinzie street next week.

**Bending Strength of Old Rails.**

Recent tests of old rails for bending strength at the Watertown Arsenal have given some interesting facts to be considered in employing old rails for structural purposes. When the rail was so placed as to bring the head in tension and the base in compression the rails broke with a clean fracture, but when the rail was turned over and the head put in compression and the base in tension it bended without fracture. Rails that had about $\frac{1}{16}$ in. of metal planed off from the head did not break, but bended, whether the head was in tension or compression; but when this $\frac{1}{16}$ in. was taken from the top, but not from the corners, the rail broke as before. This is explained by the theory that the thin layer of metal on the top and corners of the rail has been hardened by the pressure of the car wheels passing over it and its tensile strength greatly diminished. Once started the fracture goes across the whole cross section, but if the brittle covering of the rail be planed off the tendency to crack is destroyed and the rail bends instead of breaking.

## THE SCRAP HEAP.

**Notes.**

It is announced that the Brooklyn elevated road will run smoking cars on all trains.

Conductor Scott, who was in charge of the eastbound train, No. 6, which was involved in the collision at Nichols, Mich., Oct. 20, was tried last week on a charge of manslaughter, but was acquitted.

A dispatch from Columbus, O., reports that the police have raided a printing office in that city and secured a quantity of counterfeit tickets which had been printed in the name of the Detroit, Lansing & Northern.

The express trains between New York and Boston, starting from either end of the route at 12 o'clock noon, are to be taken off Dec. 31 on account of the falling off of business. These trains run over both the Boston & Albany and the New York & New England.

The Lehigh Valley road seems to be following up the lawbreakers. It is stated that two strikers have been arrested at White Haven for interfering with policemen and that some telegraph operators have been arrested for causing the wreck of a train during the strike.

Nine passenger conductors who were discharged from the Seattle, Lake Shore & Eastern have sued the Receiver, asking the United States Court to compel him to give them an investigation by filling specific charges against them with a committee of investigation of their Brotherhood.

A press dispatch from Detroit states that the Detroit, Lansing & Northern will restore wages on Jan. 1 to the rates in force last August. The General Manager says that business does not warrant the increase, but that he "will try it in the hope that the added zeal of the employes will increase traffic."

A despatch from Fort Plain, N. Y., reports that a man of that town, J. Harvey Smith, has received $80,000 from the Chicago & Grand Trunk on account of injuries to himself and family in the collision near Battle Creek, Oct. 20. Mr. Smith had a wife, a son and a daughter. The son died of his injuries.

The N. O. Nelson Manufacturing Company, of St. Louis, whose shops are operated on the profit-sharing plan, announces that the 25 per cent. deducted from the wages of the men since August will be paid to them in full on Jan. 17. The dividend for the current year is 7 per cent. It will be remembered that the employes voluntarily accepted the 25 per cent. reduction when the financial stringency began.

The suspension of passenger trains on the Eastern Division of the Erie on Christmas day was quite radical, the Sunday time-table being put in effect, and all week day trains (except those corresponding to trains on the Sunday time-table) being taken off. This arrangement was made throughout the Eastern Division and branches and the same will be in force on Jan. 1. The Sunday time-table, on most parts of the road, has from 25 to 40 per cent. of the number of trains running week days.

Suit has been brought by the city of Chicago against the Chicago, Milwaukee & St. Paul road and the Pennsylvania Company to recover damages for money paid out by the city to individuals on account of the erection of bridges over these roads. The amount of damages sought is only $1,500, the bill being based on a claim in connection with the construction of the Western avenue viaduct, but a victory for the city will mean the recovery of thousands of dollars, as there are a number of other and more important cases pending in which the same principles are involved.

A lawsuit against the American Casualty Company for commissions, which an agent claims have not been paid to him, brings out the fact that that company issued policies to the Boston & Albany, the Central Vermont and the Old Colony railroads and also the West End Street Railroad of Boston. The agent is suing for $33,000 commissions. It has been reported in a New York paper that the Long Island road will enter suits against the individuals composing the Board of Directors of the insurance company, to recover what their company owes the Long Island road for losses by the Parkville collision.

On the application of the Receivers of the Northern Pacific, Judge Jenkins, of the United Court at Milwaukee, has issued an injunction warning employees to refrain from "Combining and conspiring to quit with or without notice the service of the road with the object of crippling or embarrassing its operation, and generally from interfering with the officers and agents of the Receivers or their employees in any manner by actual threats or otherwise." The application was made in consequence of the threats of employees to strike if the reduction in pay ordered for Jan. 1 should be put into effect.

Train No. 3 of the Missouri, Kansas & Texas was shot at by robbers near Vinita, Indian Territory, Dec. 22, and the fireman injured. On the night of the 23rd a passenger train of the Mobile & Ohio was stopped near Forest Lawn, Ill., and nearly all the passengers robbed. At Seminole Station, Indian Territory, on the night of Dec. 24, a passenger train was stopped by eight robbers, who ran a freight car upon the main track so as to make an effectual "stop" signal, and the passengers were robbed. Not a shot was fired. On the night of the 23rd an express train on the Southern Pacific was stopped by two masked men about 12 miles north of Los Angeles and the express car blown open; but the robbers got nothing except what they took from the persons of trainmen.

In accordance with a summons by the Railroad and Warehouse Commissioners of Illinois, certain officers of the Indiana & Illinois Southern have appeared before the board to show why their road had not been improved as directed by a previous order. Mr. P. H. Blue, General Manager, explained that every arrangement had been made last summer to put the road in safe condition, but owing to the financial panic the execution of the plans became impossible. He assured the commission that as soon as spring opens new ties and new rails would be put in and all necessary means adopted to put the road in good shape. It is understood that the Commissioners are satisfied with this assurance, the officers having agreed to restrict the speed of trains to a rate approved by the commission.

A suit is now being tried in Illinois in the United States Circuit Court in which the Government seeks to condemn for a section of the Hennepin Canal a strip of land along Bureau Creek, 8 miles long and 300 feet wide, owned in part by the Chicago, Rock Island & Pacific Railway. The Government concedes that the defendants are entitled to fair compensation for land actually taken, but is not willing to pay consequential damages, while the defendant takes the position that it is entitled to compensation for injury that may be done to its lands by making the canal in addition to the price of land taken. This canal is to be about 77 miles long and will run from a point near Hennepin, on the Illinois River, westward to Rock River and thence to the Mississippi River. There will also be a feeder 25 miles long, starting at Dixon and connecting with the canal.

**Engineering Lectures in New York.**

The University of the City of New York announces the following lectures in engineering subjects for the coming three months by the following prominent engineers: Carroll P. Bassett, Jan. 3, on the Construction of Sewers; Maj. A. F. Sears on The Engineer; Downing Vaux, Landscape Gardening at the World's Fair; E. Weyman, Jr., Points on the Construction of Masonry Dams; Prof. John J. Stevenson, Equipment of Expeditions; Prof. Charles B. Brush, First Years of Practice.

**Coal for the Pacific Coast.**

Some of the newspapers have said that an order has been placed for 25,000 tons of coal to be brought to the Pacific Coast from Tonquin, for use on some of the California railroads. So far as we can ascertain there is no truth in this story. The high price of coal on the Pacific Coast naturally keeps railroad officers on the alert for new sources of supply, but it is hardly possible that coal from Asia could be sold in competition with that from the State of Washington and British Columbia, where there is an abundance and of good quality.

**New Engineering Building—University of Illinois.**

On Jan. 13 the cornerstone of a new building for the department of engineering of the University of Illinois, Champaign, Ill., was laid. The addition of new buildings, the increased force of instructors, the extension of courses of study and the advances of departments, and, last but not least, putting women on the faculty are the prominent advances made by this institution during the past two years. The new building is being built with $160,000 appropriated by the Illinois Legislature for an engineering building from prize plans selected from those of competing architects who have graduated from the institution. The successful competitor is Mr. George W. Bullard, of the class of '82, of Tacoma, Wash. The building is to be a three story structure 200 × 76 f with an extension in the rear 72 ft. × 66 ft.. It w comprise laboratories, drafting-rooms, testing-room library and a large assembly room for the use o engineering societies. It will contain all the necessary accessories, including photographic testing, and research laboratories. The drawing-rooms are lighted from above. The materials will consist of Joliet stone for underground foundations, Cleveland limestone to the water table, and the superstructure will be built of buff colored hydraulic pressed brick with terra cotta for cornice and other ornaments. Addresses were made by Dr. Robert H. Thurston, of Sibley College of Mechanical Engineering of Cornell University, on "Engineering a Learned Profession,' and by Prof. Irs O. Baker, who presented a historical sketch of engineering progress in the University of Illinois. In this sketch he announced that Illinois University now ranks third in attendance in the engineering departments of the colleges in the United States, and claimed for it the pride of establishing the first shop wherein students could secure practical instruction in connection with the theoretical. Prof. N. C. Ricker made an address on architecture.

**The Hicks Stock Car Co.**

Mr. Henry O'Hara, of St. Louis, has applied to the Circuit Court in Chicago for a receiver for the Hicks Stock Car Co., which he says is insolvent. Mr. O'Hara claims to be a stockholder in the company to the extent of 2,123 shares of preferred stock, and he says it owes about $2,000,000, while its assets do not exceed $500,000. Mismanagement of affairs is charged in the bill filed by O'Hara. Mr. O'Hara says further that he with others entered into a written guaranty to secure the payment of $92,000 owed by this company to the Chemical National Bank. The specific time has expired, and he with the other signers is threatened with suit; hence his action. Mr. A. J. Edward, President of the Hicks Stock Car Company, denies Mr. O'Hara's allegations, claiming that the company is solvent. The company gave Mr. O'Hara last spring a contract to build 2,600 cars, on which contract there is now due about $1,800, and that including all accounts the company now owes him about $10,000, to offset which company has a claim against him of $70,000 for non-fulfillment of contract and defective work.

**Lake Freights from Duluth.**

The season just closed, though the figures of transportation values are not computed, has seen an average freight rate on wheat, Duluth to Buffalo, approximately 1,000 miles, of $\frac{5}{10}$ of a mill per ton per mile, net to the vessel. Iron ore has been carried, average rate, at .65 of a mill per ton per mile. Anthracite coal was carried 1,000 miles for 25 cents, average all season. Never in the history of the lake trade have there been such averages as these. As a result only about 7,000 tons of freight tonnage are being built this winter at lake yards, against an average for six or seven years of about ten times that.

**The Chester Bridge Disaster.**

The grand jury at Springfield, Mass., has taken evidence concerning the Chester Bridge disaster, but has found no indictment. It appears from interviews with the District Attorney that this outcome is due to the conviction on the part of the jurors that an indictment for criminal negligence would not lie against the persons responsible unless a wanton disregard of human life could be proved. But the jury put on record a censure of the road in the following minute:

> The grand jury of Hampden County having heard and carefully considered the evidence relating to the disaster on the Boston & Albany Railroad at Chester on Aug. 31 last, report that, while in their judgment, the railroad company was guilty of a neglect of duty in its failure to employ a competent engineer to oversee the work on the bridge during such time as its prosecution was liable to endanger the safety of passengers on said company's trains, and the Superintendent employed by R. F. Hawkins in making the repairs on the bridge neglected to properly instruct the foreman who had the immediate charge of the work, upon all the evidence we are unable to find that any person directly or indirectly connected with the work on the bridge was guilty either of criminal carelessness or criminal negligence.

Action of this kind by a jury is very unusual, and, according to some Massachusetts lawyers, almost without precedent. It would seem that the decision to hold no person criminally responsible is due in part to the action of District Judge Stevens, who held the inquest. Judge Stevens' report, published a few weeks ago, very clearly set forth the responsibility of the railroad company for not keeping a competent inspector constantly on the work during the progress of repairs on the bridge, but he held no one for trial.

The temporary bridge which was built around the

wreck at Chester was partially carried away by a freshet last Sunday, interrupting traffic over the road for a day or two.

**Roads for Which Receivers Were Appointed in 1893.**

| Road. | State. | Miles | Funded debt. | Capital stock. |
|---|---|---|---|---|
| Dutchess County | N. Y. | 12 | $350,000 | $300,000 |
| †Washington Southern | Wash. | 30 | *600,000 | *600,000 |
| Dover & Statesboro | Ga. | 10 | 50,000 | 100,000 |
| N. Y. & Massachusetts | N. Y. | 40 | 24,000 | 1,014,000 |
| Philadelphia & Reading | Pa.,N.J | 1,185 | 152,000,000 | 40,426,000 |
| Chatt., Rome & Columbus | Ga. | 138 | 2,090,000 | 2,800,000 |
| St. L., Cape Gir. & S. W. | Mo. | 103 | 1,150,000 | 1,150,000 |
| Annap. & Balt. Shr. Line. | Md. | 28 | 1,000,000 | 500,000 |
| Cincin., N. O. & Tex. Pac. | Ky.Tn. | 336 | 15,935,000 | 3,000,000 |
| Macon & Northern | Ga. | 105 | 2,200,000 | 1,200,000 |
| Western N. Y. & Pa. | Pa. | 641 | 34,164,000 | 19,700,000 |
| Santa Fe Southern (n. g.) | N. M. | 39 | *390,000 | *390,000 |
| Tol., Ann Arbor & N. M. | Mich. | 287 | 7,386,000 | 6,500,000 |
| Baltimore & Lehigh | Md.,Pa | 79 | 2,500,000 | 3,375,000 |
| Toledo, St. L. & K. C. | O.In.Il. | 451 | 9,000,000 | 17,055,000 |
| Norfk., Albem. & Atl. (n. g.) | Va. | 18 | 500,000 | 500,000 |
| Port Royal & Aug. | S. C. | 112 | 1,862,000 | 750,000 |
| Savannah & Western | Ga. Ala | 628 | 7,135,000 | 3,000,000 |
| Port Royal & West Car. | S. C. | 227 | 2,500,000 | 1,418,000 |
| Little Rock & Mem. | Ark. | 133 | 3,250,000 | 3,250,000 |
| Bir., Shef. & Tenn. Riv. | Ala. | 119 | 2,975,000 | 3,275,000 |
| St. Louis, Chi. & St. P. | Ill. | 94 | 750,000 | 2,000,000 |
| Boston & Albany (Ga.) | Ga. | 22 | *220,000 | *220,000 |
| Omaha & St. Louis | Mo.,Ia. | 144 | 3,639,000 | 4,533,000 |
| Seattle, Lake Sh. & East. | Wash. | 246 | 5,675,000 | 4,150,000 |
| Stuttgart & Ark. Riv. | Ark. | 25 | 275,000 | 500,000 |
| Findlay, Ft. W. & West. | Ohio. | 49 | 1,840,000 | *1,000,000 |
| Louisville Southern | Ky. | 127 | 5,000,000 | 7,000,000 |
| North Gal., Hous. & K. C. | Tex. | 16 | *300,000 | *300,000 |
| N. Y., Lake Erie & Wn. | N.Y.Pa | 1,103 | 77,643,000 | 85,963,000 |
| Pittsbg., Akron & West. | O. | 165 | 2,450,000 | 4,230,000 |
| Prescott & Arizona Cen. | Ariz. | 73 | 1,550,000 | 1,200,000 |
| Rio Grande So. (n. g.) | Col. | 172 | 4,310,000 | 4,310,000 |
| Louisville, St. L. & Tex. | Ky. | 146 | 5,000,000 | 3,471,000 |
| Hutchinson & Southern | K., L.T. | 82 | 1,025,000 | 7,320,000 |
| ‡Northern Pac. & brachs. | M Detc | 4,374 | 128,000 000 | 85,140,000 |
| Phila., Reading & N. E. | N. Y. | 167 | 11,100 000 | 6,600,000 |
| Wisconsin, Minn. & Pac. | Minn. | 217 | 3,228,000 | 3,229,000 |
| Cleveland, Cantor & So. | O. | 210 | 3,999 000 | 13,251,000 |
| Wheeling Bridge & Ter. | W. Va | 6 | 5,500,000 | 1,500 000 |
| ‡Chic., Peoria & St. L. | Ill | 167 | 2,953,000 | 3,500,000 |
| ‡Jacks'v., Louis. & St. L. | Ill. | 128 | 1,680,000 | 1,500,000 |
| ‡North & South. | Ill. | 53 | 600,000 | 2,300,000 |
| Tex., Sab. Val. & N. W. | Tex. | 58 | 475,000 | 475,000 |
| Lancaster & Hamden | O. | 14 | 280,000 | 280,000 |
| Wisconsin Central | Ill.Wis | 915 | 17,260,000 | 15,000,000 |
| Sioux City & Northern | Ia.S.D. | 96 | 1,920,000 | 1,441,000 |
| Chicago & Northern Pac. | Ill. | 26 | 25,742,000 | 30,000,000 |
| ‡Union Pacific | Nb.Wy | | 120,000,000 | 60,868,000 |
| ‡Union Pac., Den. & Gulf | Col. et. | 7,681 | 22,436 000 | 33,837,000 |
| Ft. W. & Den. City | Tex. | | 8,342,000 | 9,375,000 |
| Pan Handle | Tex. | | 225,000 | |
| Sioux City, Ter | Iowa. | 16 | *500,000 | *500,000 |
| Ky. & Ind. Bridge | Ky.Ind | 14 | 2,300,000 | 1,700,000 |
| Det., Bay City & Alpena | Mich. | 224 | 2,500,000 | 1,670,000 |
| Sioux City, O'Neill & W. | Neb. | 130 | 2,340,000 | 3,600,000 |
| Duluth, Missabe & Nor. | Minn. | 96 | *2,000,000 | *2,000,000 |
| Tennessee Midland | Tenn. | 136 | 2,711,000 | 3,146,000 |
| Paducah, Tenn. & Ala. | Ky. | 118 | 2,432,000 | 2,432,000 |
| Sedalia, Warsaw & So. | Mo. | 43 | 338,000 | 516,000 |
| Tol. & Ohio Cen. Exten. | O. | 60 | 2,100,000 | 2,100,000 |
| Chicago & Southeastern | Ind. | 100 | 1,625,000 | 2,000,000 |
| Port Jervis, Mont. & N. Y. | N. Y | 41 | 361,000 | 409,000 |
| Middlesborough Belt | Ky. | 17 | 424,000 | 1,000,000 |
| Winona & Southwestern | Minn. | 117 | 2,118,000 | 2,292,000 |
| Utah Central | Utah. | 32 | *600,000 | *600,000 |
| Lake Erie, Alliance & So. | O. | 36 | 2,035,000 | 3,000,000 |
| Mary Lee Coal & Ry. | Ala. | 7 | 184,000 | 500,000 |
| Carolina, Cum. Gap., Chic | S. C. | 24 | 925,000 | 500,000 |
| Altoona, Clear. Nor. (n g.) | Pa. | 13 | 22.000 | 43,000 |
| Minnesota & Wisconsin | Wis. | 26 | 520.000 | 520,000 |
| Total 71 roads | | 22 534 | $753,917,000 | $534,035,000 |
| Total bonds and capital stock | | | | $1,287,952,000 |

* Partly estimated.
† Receiver Washington Southern appointed Jan. 30, discharged Dec. 1.
‡ Subsequently 22 leased lines of the Northern Pacific, aggregating about 1,200 miles, were placed in the hands of separate receivers, but their mileage is included with the Northern Pacific.—"Railway Age."

The foregoing list is taken from the *Railway Age*. To this must be added the Atchison, Topeka & Santa Fe with over five hundred millions of stock and bonds and the New York & New England. The inclusion of the Duluth, Missabe & Northern is doubtless a mistake. A contractor began action last summer, but the application was resisted by the company and the court has as yet issued no order.

## LOCOMOTIVE BUILDING.

The Pittsburgh Locomotive Works on Dec. 22 shipped six of the 20 locomotives ordered for the Manhattan Elevated Railroad, New York.

The Baldwin Locomotive Works have received from the Norfolk & Western an order for nine compound consolidation freight locomotives, duplicates of No. 330, which was exhibited at the World's Fair. The general dimensions are as follows: Cylinders, Vauclain pattern, 14 × 24 × 24; driving wheels, 56 in. diameter; weight in working order, 135,800 lbs.; weight on driving wheels, 120,600 lbs.; boiler, Belpaire pattern, 60 in. diameter; total wheel base, 22 ft. 9 in.; driving wheel base, 14 ft 10 in.; tank capacity, 4,000 gallons. With these engines the Norfolk & Western will have in service 45 Vauclain compounds.

## CAR BUILDING.

The Baltimore & Ohio Southwestern is reported in the market for 1,000 new cars.

The Buffalo, Rochester & Pittsburgh gave an order last week for 250 gondola cars to the Jackson & Woodin Mfg. Co., of Berwick, Pa.

The Pullman Car Company is building 250 refrigerator cars for the Atchison, Topeka & Santa Fe and also 300 cars for the Chicago & Northwestern, these cars being part of the order for 600 let by the railroad company a few weeks ago.

## BRIDGE BUILDING.

**Boston, Mass.**—The City Engineer of Boston has prepared plans for a long bridge across Chelsea Creek to connect the city with Chelsea. The building of the bridge rests with the Harbor Commissioners, and it is expected that they will accept the plan submitted and order the bridge erected.

**Columbus, O.**—The County Commissioners have decided to build a bridge over the canal at Lockbourne, this county; length of span 78 ft. and roadway 18 ft in the clear. Bids will be received until Jan. 31.

**Milton, Pa.**—Several joint sessions of the Commissioners of Northumberland and Unionc counties have been held to consider the building of an iron bridge across the west branch of the Susquehanna River from Milton to West Milton, but little has been accomplished so far beyond a decision to build the bridge.

**Ottawa, Ont.**—The City Engineer has been ordered to prepare plans and specifications and ask for tenders for an iron bridge with a 12-ft. roadway and two spans to connect the city with Porter's Island. The length is about 250 ft.

The agreement between the city and the Pontiac & Pacific Junction Railroad for the construction of a railroad and traffic bridge over the Ottawa River has been signed.

**Port Stanley, Ont.**—The contract for the steel bridge has been awarded to the Dominion Bridge Co. at $4,238 for iron work and for masonry to Usher & Sangster of Thorold, for $5,734; total, $9,972. The following tenders were received for iron work: Canadian Bridge Co., Montreal, $4,408; A. & E. Loignon, Montreal, $3,950; Central Bridge Co., Peterboro, $4,554; Dominion Bridge Co., Montreal, $4,238; Stratford Bridge Co., $4,989; Hamilton Bridge Co., $4,800; Belleville Bridge Co., one tender for $4 266 and $3,521; King Bridge Co., Cleveland, $4 862.

**St. Stephens, N. B.**—Plans and specifications are to be prepared, and tenders called for, for the construction of a bridge across the St. Croix River.

**Scranton, Pa.**—An ordinance providing for the construction of the Roaring Brook and Sweetland and Linden street bridges will be carried through councils, immediately, in order to have the measure in shape to be voted upon by the citizens at the coming February elections. The bridge over Roaring Brook will have six spans and will be 60 ft. wide.

**Wellsboro, Pa.**—Contracts for the erection of two iron county bridges have been let as follows: One over Crooked Creek in Tioga village, 125 ft. long and 16 ft. wide, to the Owego Bridge Co., for $5,000; the other, over the Cowanesque, in Deerfield, 150 ft. long and 14 ft. wide, to the Nelson-Buchannan Bridge Co., of Chambersburg, Pa., for $5,700. The prices for both structures include the masonry.

## MEETINGS AND ANNOUNCEMENTS.

**Dividends:**

Dividends on the capital stocks of railroad companies have been declared as follows:

*Baltimore & Ohio*, semi-annual, 3 per cent. on the preferred stock, payable Jan. 2.

*Canada Southern*, semi-annual, 1¼ per cent. and ½ per cent., payable Feb. 1.

*Chicago, Rock Island & Pacific*, quarterly, 1 per cent. payable Feb 1.

*Cincinnati, Hamilton & Dayton*, quarterly, 1 per cent., payable Jan. 2.

*Cumberland Valley*, semi-annual, 4 per cent.

*Dayton & Michigan*, quarterly, 2 per cent. on the preferred stock, payable Jan. 2.

*Fitchburg*, semi-annual, 2 per cent. on the preferred stock, payable Jan. 15.

*Lake Shore & Michigan Southern*, semi-annual, 3½ per cent., payable Jan. 1.

*Mexican Northern*, quarterly, 1½ per cent., payable Jan. 20.

*Michigan Central*, semi-annual, 2 per cent. and 1½ per cent., payable Feb. 1.

*New York Central & Hudson River*, 1¼ per cent., payable Jan. 15.

*Norfolk & Southern*, quarterly, 1 per cent., payable Jan. 10.

*Petersburg*, annual, 3 per cent. on the common and preferred stocks, payable Jan. 2.

*Richmond, Fredericksburg & Potomac*, 3½ per cent., on the common stock, payable Jan. 2.

*Richmond & Petersburg*, semi-annual, 3½ per cent., payable Jan. 2.

*Worcester, Nashua & Rochester*, 3 per cent., payable Jan. 2.

**Stockholders' Meetings.**

Meetings of the stockholders of railroad companies will be held as follows:

*Bay of Quinte Bridge Co.*, annual, Belleville, Ont., Jan. 8.

*Boston & Lowell*, annual, Boston, Mass., Jan. 3.

*Brooklyn Elevated*, annual, Brooklyn, N. Y., Jan. 3.

*Cleveland & Pittsburgh*, annual, Cleveland, O., Jan. 3.

*Grand River Valley*, special, Jackson, Mich., Jan. 10.

*Duluth & Winnipeg*, annual, Duluth, Minn., Jan. 12.

*Hamilton & Barton Incline*, annual, Hamilton, Ont., Jan. 16.

*Kings County Elevated*, annual, Brooklyn, N. Y., Jan. 10.

*London & Port Stanley*, annual, London, Ont., Jan. 19.

*New York & Northern*, adjourned, New York City, Jan. 4.

*Nipissing & James Bay*, annual, Toronto, Jan. 4.

*Philadelphia & Reading*, annual, Philadelphia, Pa., Jan. 8

*Philadelphia, Wilmington & Baltimore*, annual, Wilmington, Del., Jan. 8.

*St. Catharines & Niagara Central*, annual, St. Catharines, Ont., Jan. 22.

*Shamokin, Sunbury & Lewisburg*, annual, Philadelphia, Pa., Jan. 8.

*Western New York & Pennsylvania*, annual, Philadelphia, Pa., Jan. 8.

**Technical Meetings.**

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Traveling Passenger Agents' Association* will hold its convention in New Orleans, La., Jan. 9.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each alternate month, commencing January.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo, on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

**Boston Society of Civil Engineers.**

The next meeting will be held at the rooms of the Society at Wesleyan Hall, Bromfield street, Boston, Mass., Jan. 24.

**Civil Engineers' Club of Cleveland.**

A meeting was held on Dec. 12, 1893; 33 members and visitors present. The applications of Messrs. E. A. Handy and C. A. Carpenter for active membership were read. Mr. L. E. Chapin, of Canton, O., presented a paper entitled "Sewage Disposal at Canton, O.," which was discussed by Messrs. E. P. Roberts, Hosea Paul, C. M. Barber, W. H. Searles and A. H. Porter.

**Engineering Association of the South.**

The Engineering Association of the South met at Nashville, Tenn., Dec. 14, with a fair attendance. Messrs. John M. Picton, G. F. Blackie and C. E. Bowron were elected to membership. The following officers have been elected for the next year: President, Charles Hermany, Louisville; First Vice-President, W. C. Smith, Nashville, Tenn.; Second Vice-President, J. Kruttschnitt, Houston, Tex.; Secretary, Hunter McDonald, Nashville, Tenn.; Treasurer, W. T. Magruder, Nashville, Tenn.; Directors from Tennessee, W. W. Carson, Knoxville, W. L. Dudley, Nashville, and E. C. Lewis, Nashville; Director from Kentucky, John B. Atkinson, Earlington; Director from Georgia, George H. Crafts, Atlanta.

Mr. G. D. Hicks, Division Superintendent Nashville, Chattanooga & St. Louis Railroad, presented a paper on the Hobbs Island Transfer. This transfer was described in the *Railroad Gazette* Oct. 13, 1893, page 745. The next meeting of the Association will be on Jan. 9.

**Association of Engineers of Virginia.**

The second informal monthly meeting of the present season was held Dec. 20 at 8 p. m., the Association meeting in the office of the City Engineer for convenience of access to plans illustrating the subject for the evening, which was "The Sewerage System of the City of Roanoke." Mr. William Dunlap, City Engineer, opened the subject with a paper giving a historical sketch of the city and of the various plans proposed for the disposal of its sewage and drainage by Mr. R. Hering in 1883 and 1891, by himself in the latter year and by Messrs. Gray & Hering in 1892. He followed with an account of the work actually accomplished to present date, embracing 59,900 lineal feet of drain of various diameter from 8 to 32 in. at a total cost of $60,762, closing with a brief discussion of the various formulæ and tables in use for determining the size of drains and of the system of ventilation to be adopted. Little time being left for general discussion, the subject was adjourned to a future meeting and the paper referred to the Committee on Publication.

The next informal meeting will be held on Wednesday, Jan. 17; subject, "Railroad Signaling," to be opened by C. S. Churchill, Norfolk & Western R. R., or, as alternative, discussion on Mr. Dunlap's paper.

The annual meeting of the Association will be held at Roanoke Jan. 31. At this meeting the following officers will be elected:—A President to succeed C. S. Churchill, term expired; a Vice-President to succeed W. H. Adams, term expired; three directors to succeed D. C. Humphreys, C. G. Cushman and W. E. Anderson, terms expired; a Secretary to succeed L. J. Carmalt; a Treasurer to succeed J. R. Schick.

## PERSONAL.

—Mr. E. B. Cooke, Auditor of the Evansville & Terre Haute road, died at Evansville, Ind., on Dec. 23, after a long illness.

—Mr. O. O. Esser, Superintendent of the Wyoming Division of the Lehigh Valley, has been given a month's leave of absence, and is now at Hot Springs, Ark.

—E. C. Clark has retired from the Presidency of the Standard Car Coupling Company, and is succeeded in that office by George A. Post, who is promoted from the Vice-Presidency.

—Mr. G. W. Cushing, formerly General Master Mechanic of the Union Pacific, with headquarters in Omaha, has assumed a similar position with the Cincinnati Southern, with headquarters at Paducah, Ky.

—Mr. Charles A. Beach, Assistant Superintendent of the Western Division of the New York Central & Hudson River Railroad, has resigned to go to the Lehigh Valley road. His resignation is to take effect on Jan. 1.

—Mr. George W. Inge has been appointed Superintendent of the Sedalia, Warsaw & Southwestern with headquarters at Sedalia, Mo., the road being a branch of the Missouri Pacific, but now operated by a receiver.

—Mr. H. C. Barlow, formerly General Manager of the Wisconsin Central, now Vice-President and General Manager of the Evansville & Terre Haute, is now Acting President. There will be no President elected for the present.

—Mr. D. J. Mackey resigned as President and director of the Evansville & Terre Haute road last week. Mr. W. H. Tilford, of New York City and former director, was elected a director in place of Mr. Mackey, and also Chairman of the Board of Directors.

—Mr. W. C. Alvord, General Freight Agent of the Jacksonville Southeastern, and Mr. E. A. Nixon, Assistant General Freight Agent of the same company, have resigned and the latter office has been abolished. Mr. H. E. Pilcher, the General Agent at St. Louis, Mo., has been appointed Acting General Freight Agent.

—Mr. Braman B. Adams, father of Mr. Adams of the *Railroad Gazette*, died at his home in Milford, Mass., on Dec. 19 at the age of 73. Mr. Adams was in the service of the Boston & Albany and its predecessor, the Western Railroad, 39 years, having begun in 1842. He was Station Agent at Palmer from 1861 to 1881, retiring in the latter year.

—Maj. A. C. Knapp, Traffic Manager of the Georgia Southern & Florida, has resigned that position, to take effect Jan. 1, when the office will be abolished and the duties of the department assumed by Mr. J. Lane, General Manager of the company. Mr. Knapp was formerly General Freight Agent, being appointed to that position in 1890, when the road was opened. He was formerly Superintendent of the Southwestern of Georgia.

—Col. James F. How, Second Vice-President of the Wabash, has decided to retire from active business life and has tendered his resignation, to take effect Feb. 1. At a meeting of the directors held in New York recently, his resignation was accepted, and Mr. Charles M. Hayes, General Manager, selected to succeed him. Colonel How thus ends 25 years of railroad service, which began with the Northern Missouri, and continued with its successors.

—Mr. Albert B. Pullman died at his home in Evanston, Ill., on Dec. 18 after a short illness. Mr. Pullman was Vice-President of the Pullman Palace Car Company for 25 years, retiring in 1887. He was also President of the A. B. Pullman Co., of Chicago. He was born at Auburn, N. Y., in 1828, and started there in the business of cabinet-making. In 1859 he went to Chicago with his brother, Mr. George M. Pullman, and in the following year began his long connection with the sleeping car company.

—Mr. Arthur Sewall, who has been President of the Maine Central for nine years, has resigned both as President and director at the annual meeting last week. He has been associated with the Maine Central for many years. He first became director in 1876, and was elected President in 1884. At that date he was elected President of the Portland, Mt. Desert & Machias Steamboat Co. He has also been connected with other railroads, the Atchison, Topeka & Santa Fe, where he was a director for some of the branch lines. He was a director of the Mexican Central for three years to 1886, President of the Eastern Railroad of Massachusetts in 1883-4, director of the Boston & Maine in 1891-3, director of the New York & New England since 1888 and of the Portland & Rochester since 1884. All his railroad business has been in addition to his extensive business as a shipbuilder.

—Mr. George C. Magoun, the well-known banker, and member of the firm of Baring, Magoun & Co., of New York, died in that city on Dec. 20. Blood poisoning, which resulted from an operation performed some weeks ago, was the direct cause of his death. Mr. Magoun was born in Cambridge, Mass., in 1841, and began his business life as a clerk in the office of Lawson Valentine & Co.; becoming a clerk in the banking office of Kidder, Peabody & Co., of Boston, in 1865. Three years later he removed to New York to establish a branch office. In 1891 the present firm of Baring, Magoun & Co. was formed. This change had come about through the failure of Baring & Co., of London, soon after the reorganization of the Atchison, Topeka & Santa Fe Railroad, in which that firm had been largely interested, and its failure threw the financial management of the road into the hands of Mr. Magoun, and up to the time of his death he was the Chairman of the Board of Directors of the road.

—Paul Louis Jousselin, President of the Society of Civil Engineers of France, died recently. He was born in 1830 and was an engineer by inheritance, his father and grandfather having been members of the Ponts et Chaussées. He was educated at the École Centrale, began his active career on the Northern Railroad, and in 1857 entered the service of the Paris, Lyons & Mediterranean, where his career was made. He was 33 years in that service, having been much of the time Chief of the Third Division, which corresponds to the Operating Department of our own railroads. He left the service in 1892 to retire from active work. He was a man of very inventive mind and did a great deal to introduce electricity, the apparatus known by his name, for communication between station agents and signalmen, having long been very generally used on the system. He held many honorable positions and was an officer of the Legion of Honor. He became a member of the Society of Civil Engineers in 1854, Vice-President in 1889 and President in 1893.

—Mr. William Clark Young, who died in New York Dec. 22, was one of the last of the pioneers of railroad construction and operation in the United States; indeed, we know of no survivor who was active and prominent in the first years of railroading. One of the last was John H. B. Latrobe, who died two years ago last September, 88 years of age. Before him the illustrious John B. Jervis had died in January, 1885, aged 89, and his equally gifted colleague, Horatio Allen, died Dec. 31, 1889, at the ripe old age of 87. Mr. Young was more prominently identified with civil engineering work, while his contemporary engineers named were also prominent in the development of the mechanical side of engineering, and especially of the locomotive. To Mr. Young belongs, it is said, the credit of having first used crossties on an American railroad, stone locks having been used theretofore. Mr. Young was born at Youngstown, O., Nov. 25, 1799, and was therefore a little past 94 years of age at the time of his death. As a boy he began surveying, and in 1816 he helped to survey the islands in Lake Ontario; in 1817 he was engaged in the Erie Canal surveys, and in 1818 went to West Point Military Academy, from which he was graduated in 1822. At his death he was the oldest graduate of that institution, which distinction now falls to General George S. Greene, Past President American Society of Civil Engineers. After four years service in the Second Artillery U. S. Army, Mr. Young resigned his commission to follow the occupation of a civil engineer. His first work was a preliminary survey of a canal in Dutchess County in 1826, and his first experience in railroad surveys and construction began in 1829 on the Western Railroad of Massachusetts (now the Boston & Albany). Then he was successively inspector of construction on the Baltimore & Ohio, Resident Engineer of the Saratoga and Schenectady, and Chief Engineer of the Utica and Schenectady railroads. It was upon the Saratoga & Schenectady road that he first used crossties, in 1831. In 1849 he was made Chief Engineer of the Hudson River Railroad, and in 1851 its President, which latter office he resigned at the end of two years. He next went to the Isthmus to take charge of the construction of the Panama Railroad in 1853 and remained there but a little time because of fever; was elected President of the company, but resigned in a few months, and from 1855 to 1857 was Superintendent of the Western Division of the New York Central. Since then he has been practically retired. This was his last active service in a professional capacity, though he retained his intellectual faculties, sight and hearing almost entirely unimpaired. He was alert and erect and naturally took much pride in being the veteran of the veterans, and in being the survivor of so many pioneers of American Railroad construction.

## ELECTIONS AND APPOINTMENTS.

*Brockville, Westport & Sault Ste. Marie.*—The annual meeting was held at Brockville, Ont., on Dec. 19, when directors were elected as follows: H. M. Hoyt, Philadelphia; S. Hunt, Cincinnati; W. P. Parish, Athens; W. C. Fredenburg, Westport; Colonel W. H. Cole, D. W. Dowley, D. Derbyshire, H. Weatherhead, G. R. Webster and James Mooney, Brockville. H. M. Hoyt was elected President; W. H. Cole, Vice-President; S. Hunt, General Manager; J. Mooney, Treasurer, Superintendent and General Freight Agent; E. A. Geiger, Secretary and General Passenger Agent.

*Buffalo & Susquehanna.*—The following officers have been recently elected for this company, which is a consolidation of the various lines built by F. H. and C. W. Goodyear in northern Pennsylvania. Under the law of Pennsylvania, it is necessary that a resident of that State shall act as president, and on this account M. E. Olmsted, of Scranton, Pa., has been elected to that office. F. H. Goodyear, of Buffalo, is First Vice-President and Chairman of the Board. The other officers are: Charles W. Goodyear, Second Vice-President and General Manager; H. C. Underhill, General Freight and Passenger Agent; E. O. Cheney, Treasurer; W. I. Lewis, Counsel; N. N. Metcalf, Secretary; H. Hutchinson, Trainmaster, and W. C. Parks, Engineer of Maintenance of Way. The general offices of the company will continue to be in Buffalo, and the office of the Secretary and Treasurer in Austin, Pa.

*Jacksonville Southeastern Line.*—H. E. Pilcher, now General Agent at St. Louis, has been appointed Acting General Freight Agent of the Chicago, Peoria & St. Louis and operated lines, with office at No. 102 North Fourth street, St. Louis, succeeding W. C. Alvord, resigned. The office of Assistant General Freight Agent has been abolished. A. A. Poland has been appointed Commercial Agent at St. Louis, E. A. Nixon having resigned.

*Maine Central.*—The annual meeting was held in Portland, Me., Dec. 20. It was voted to reduce the number of directors from 15 to 13. The following Board of Directors was elected: Payson Tucker, Portland; Lucius Tuttle, Boston; Samuel C. Lawrence, Medford, Mass.; George M. Pullman, Chicago; William G. Davis and Joseph S. Ricker, Portland; Lewis Cass Ledyard, New York, N. Y.; Henry M. Whitney and Henry R. Reed, Boston; Thomas W. Hyde, Bath; John Ware, Waterville; Franklin A. Wilson, Bangor; Francis W. Hill, Exeter. Arthur Sewall, W. T. Hart, Frank Jones, Amos Paul and C. A. Sinclair are the retiring directors. The Board of Directors organized with the choice of the following officers: Clerk, Joseph H. Drummond; Chairman, Franklin A. Wilson; Vice-President and General Manager, Payson Tucker.

*Nevada Southern.*—The annual meeting of the railroad was held at Denver last week. The following were elected as directors: I. E. Blake, Charles B. Mason, William L. Beardsley, George C. Manley, Denver; D. J. Scofield, San Francisco. Following were elected officers: President, I. E. Blake; Vice President, D. J. Scofield; Vice-President and General Manager, R. S. De Beret; Secretary and Attorney, George C. Manley; Auditor and Assistant to President, Charles B. Mason.

*Southern Pacific.*—E. B. Cushing, of Houston, resident engineer, will on Jan. 1 assume the direction and control of all new work and extensive betterments in the track department, and will exercise a general supervision over all work connected with maintenance of track.

## RAILROAD CONSTRUCTION,
### Incorporations Surveys, Etc.

**Baltimore Northern.**—This company has been incorporated this week by Baltimore capitalists. The line will begin at Baltimore and extend to Delta, where it will connect with the proposed York & Schuylkill Railroad.

**Bentonville, Fort Gibson & Southwestern.**—Articles of incorporation were filed this week in Arkansas by this company with a capital stock of $250,000. The new road will begin at Bentonville, Ark., and extend southwest to a point on the Indian Territory line. The incorporators are N. S. Henry, D. H. Woods, J. A. Rice, F. M. Bates, J. C. Knott and W. H. Cloe, all of Bentonville, Ark.

**Boston & Nova Scotia.**—Work on this company's road from Orangedale to Broad Cove Mines, Cape Breton, 35 miles, is being vigorously pushed, about 300 men having been employed during the last month clearing the right of way. The season is so far advanced that but little grading will be done before spring opens, the winter being devoted mainly to the distribution of plant and stone for the masonry and getting out ties and other timber. C. M. Odell, of Mabou, Cape Breton, is Chief Engineer.

**Buffalo & Susquehanna.**—Arrangements have been made by Messrs. F. H. & C. W. Goodyear, who are the chief owners of this road, for the proposed extension from Galeton east to Ansonia, in Tioga County, Pa., a distance of 13 miles. A terminal station will be built at the latter town and connection made with the Fall Brook road. There is little chance of any new work being undertaken east of Ansonia. The road now extends from Keating Summit, near Austin, Pa., to Galeton, on the Addison & Pennsylvania, 47 miles, with a branch of 19 miles to Cross Fork. The passenger trains have just begun running over the main line. There will be several rock cuts on the line to Ansonia, and the contractors are to carry on this work during the winter, beginning about Jan. 15.

**Canadian Pacific.**—A new survey for the extension of the Dunmore line to McLeod in Alberta has been commenced and, in spite of the inclemency of the weather at present, is being pushed forward rapidly. The survey is being made from the terminus of the Alberta Ry. and Coal Co.'s line at Dunmore.

**Chattanooga Western.**—The company has commenced grading on the north side of the Tennessee River, opposite Chattanooga, Tenn. The road is to be built to Hixon, Tenn., where connection is to be made with the Cincinnati Southern. A bridge is to be built across the Tennessee River to bring the road into the city of Chattanooga. The company has recently acquired possession of the Chattanooga Terminal Road in that city. T. J. Nicholl, of Chattanooga, is President and Chief Engineer of the road.

**Cleveland, Wooster & Muskingum.**—Tracklaying on the extension of this road, between Millersburg and Wooster, O., 20 miles, is soon to begin. The ties have been ordered and will be distributed in a few days. The contractors are McNair & Bracey, of Chicago. The road is controlled by the Baltimore & Ohio.

**Florence, Cripple Creek & State Line.**—Orman & Crooke, of Pueblo, Col., have the contract for building this road from Florence north to the Cripple Creek mines. The work has already begun, it being the purpose of the company to have its line in operation by May 1, 1894. The line will be of narrow gage (3 ft.), and not of standard gage as stated last week, and it will be 40 miles long. It will have no adverse grade out of the mining district after the ridges below Cripple Creek where the mines are located have been reached. The town site is in a sort of pocket in the hills, but the mines are all upon the sides and summits of the surrounding rounded hills. The establishing of reduction works at Florence is an important feature of this enterprise, and the builders of the railroad are also interested in this proposition. The process of treating the low grade ores of the Cripple Creek district that will not pay smelting charges is an experiment that has been tried by a small establishment at Leadville. The Florence works will have a capacity of 500 tons a day, and it is stated that from 90 to 95 per cent. of the gold can be saved by this process. In addition the company will build sampling works at Cripple Creek and will buy the ores upon the public market there.

**Florida Central & Peninsular.**—The extension to Savannah was completed on Dec. 21, the last rails being laid just north of the Altamaha River in Georgia, about 50 miles south of Savannah. The total length of the extension is 114 miles. It begins at Hart's Roads, a small station about 10 miles north of Jacksonville, and extends in a direct line to Savannah, Ga. At Savannah it connects with the South Bound road which is now also controlled by the Florida Central & Peninsular. Through the connection which that line makes at Columbia with the Richmond & Danville a new line from New York and Eastern points to Florida is formed, shortening the present routes to Jacksonville by about 40 miles.

**Minneapolis, St. Paul & Sault Ste. Marie.**—The short branch from Cameron northwest to Rice Lake, Wis., on the Chicago, St. Paul, Minneapolis & Omaha, was completed last week.

**Missouri, Kansas & Texas.**—The location for the proposed line to San Antonio, Tex., about 50 miles, is said to be now practically completed. When the company proposes to begin the grading it is not yet evident from any statements made by the officers. It is stated that Vice-President Purdy and other general officers have promised to visit Texas in a few weeks and they will then state what aid the company will ask the various towns to vote for the extension. The new road will leave the main line at San Marcos or Lockhart, Tex.

**New Roads.**—Press dispatches state that Wolf & King, railroad contractors, of Duluth, Minn., have been awarded a contract for building a 60-mile line in eastern Kentucky, connecting the coalfields of Pike County with the Big Sandy River at Whitehall.

**Nova Scotia Coast.**—Mr. Ambler, C. E., of Yarmouth, N. S., is surveying the coast line to Tusket, N. S., and as soon as the plans are completed, tenders will be called for a section of 10 miles.

**Ontario Roads.**—Application is made to the Ontario Legislature for a charter to incorporate a company to construct a road from Port Lock Harbor, on Lake Huron, or Sault Ste. Marie, northeasterly via the Desert Lake Iron Mine, to Chapleau, on the main line of the Canadian Pacific.

**Ottawa, Arnprior & Parry Sound.**—This road is now completed and open for freight and passenger traffic from Ottawa to Carp, Arnprior, Glasgow, Renfrew, Douglass and Eganville, Ont., a distance of about 70 miles, in connection with the Canada Atlantic, which is building the new road.

**Portland & Rumford Falls.**—The extension from Mechanic Falls to the Maine Central near Auburn, Me., is now practically completed. Less than a mile of track has to be laid, and this is the only work to be done excepting three miles of ballasting. The company has taken the work out of the hands of the contractors in order to hasten its completion, and the rest of the work will be done with its own forces. Frederick Danforth, of Gardiner, Me., is Chief Engineer.

**Southern Pacific.**—The construction work on the branch of the Louisiana Western building north of Crowley, La., has been stopped, although the cause is not quite apparent. This branch has been graded during the summer for 21 miles north of Crowley or Midland

through a productive country, but does not pass through any towns along its route. The tracklaying has been commenced on the southern end of the line by the contractor, John P. Hughes, of Fort Worth, but less than two miles of rails were laid when the contractor withdrew his men.

**Spokane Falls & Northern.**—The Nelson & Fort Shepherd road, which was built during the summer, is now being operated by the officers of this company for its entire length, although the latter company still maintains its existence as a distinct corporation with a charter from the Canadian Government. The line actually starts from Northport, Wash.; on the Columbia River, 10 miles south of the international boundary line, and the route into Nelson, B. C., is 65 miles long. During the winter through trains will be run from Spokane, Wash., to Nelson and to Kootenai Lake points twice each week, but in the spring it is the intention to put on daily trains. The trains are not now running into the town of Nelson, but a station has been built on a hill about three-quarters of a mile from the town, the present terminus. Next year a line will be built back along the lake into the town proper, this location being necessitated to secure an easy grade.

## GENERAL RAILROAD NEWS.

**Atchison, Topeka & Santa Fe.**—Judge H. C. Caldwell, of the United States Circuit Court, appointed J. W. Reinhart, J. J. McCook, of New York, and J. C. Wilson, of Topeka, Receivers of this system, including the St. Louis & San Francisco, on Saturday, Dec. 23, on application made before him at Little Rock, Ark., by attorneys of the railroad company, and of the Mercantile and Union Trust companies, of New York. George R. Peck, General Solicitor of the company, made the following statement: "The bills filed with the court showed that the lines were heavily involved, with maturing obligations coming on soon, and that the interest due Jan. 1 could not be paid and would be defaulted. The first mortgage bonds are $150,000,000, the second mortgage bonds, Class A, $77,000,000, and second mortgage bonds, Class B, $5,000,000. The interest due on bonds by Jan. 1 is $4,000,000 and the floating indebtedness about $6,000,000. The Receivers are Joseph W. Reinhart, President of the Santa Fe system; John J. McCook, of New York, General Counsel, and Joseph C. Wilson, of Topeka, who is now clerk of the United States District Court at Topeka, and has been twice mayor of that city. The railroads asked for the appointment of Reinhart, McCook and George A. Nickerson, one of the directors A supplementary bill will be filed on Jan. 5 at Topeka, asking for a foreclosure. The action was a friendly one to protect the owners and creditors of the system. The President in a published statement attributes it to the sudden termination of negotiations for financial relief owing to the continued financial depression in America and Europe. The obligations of the companies in time and call loans and interest due are given by Mr. Reinhart as $10,200,000. The working organization of the system will remain for the present unchanged.

**Columbus, Sandusky & Hocking.**—This company has been formed by the consolidation of the Columbus, Shawnee & Hocking and the Columbus & Sandusky Short Line. The consolidation was approved at a meeting of stockholders of both companies last week. The newly organized company will issue $10,000,000 of five per cent. gold bonds, a sufficient amount of which will be placed with the Metropolitan Trust Co. to redeem all outstanding bonds of each corporation as they mature. The old bonds may be exchanged for the new. After providing for these bonds $1,141,000 will remain in the treasury. Five million dollars of 5 per cent. non-cumulative preferred stock will be authorized, part to be exchanged for $2,152,057 of preferred stock of the Columbus, Shawnee & Hocking, and for 60 per cent., or $1,800,000, of the stock of the Sandusky & Columbus Short Line Company. The balance, $1,047,933, will remain in the treasury. Five million dollars of common stock will be authorized, $2,241,067 of which will be exchanged for a like amount of the common stock of the Columbus, Shawnee & Hocking, and 40 per cent., or $1,200,000, of the stock of the Sandusky & Columbus Short Line, leaving in the treasury $1,558,933.

**Detroit, Lansing & Northern.**—The Directors announce that the company is without funds to meet the interest to Jan. 1 on the various bonds. A default will be made on the Detroit, Lansing & Northern 7 per cent. bonds amounting to $2,672,000; the Ionia & Lansing Company's 5 per cent. bonds amounting to $70,700 and the Saginaw & West Michigan 6 per cent. bonds amounting to $566,000. As soon as a complete statement of the financial condition of the company can be made, which will probably be by February, a plan for the reorganization will be formulated.

**Dodge City, Montezuma & Trinidad.**—The directors and officers have been restrained by the Kansas State Court from taking up rails and ties on the road and removing them from the state. The road is 25 miles long from Dodge City to Montezuma, the county seat of Gray County. It had been the original intention to build 200 miles in Kansas, but construction was stopped at Montezuma. The road was built without any aid from the people, and the company has no bonded debt. It was purely the personal enterprise of J. S. Soule, of New York. The road has no rolling stock, but was operated by the Rock Island until about three months ago. Soule sold the rails and ties to railroad contractors. When the purchasers went to take up the track they were opposed by the people of Gray County.

**Everett, Port Angeles & Pacific.**—Arrangements have been perfected, it is announced, for building this line during 1894. The distance is 67 miles, of which 53 will be covered by the railroad to Puget Sound, and the remaining 14 miles by ferry.

**Lake Shore & Michigan Southern.**—The reports of earnings for the last two years ending Dec. 31, the figures being partly estimated, are published below.

| | 1893. | 1892. | Inc. or dec. |
|---|---|---|---|
| Gross earn | $23,686,519 | $22,415,383 | I. $1,235,136 |
| Operating expenses | 17,061,750 | 15,803,190 | I. 1,258,560 |
| Net earn | $6,624,769 | $6,612,193 | I. $12,576 |
| Fixed charges | 3,370,000 | 3,375,364 | D. 5,364 |
| Bal. to stock | $3,254,769 | $3,236,829 | I. $17,940 |
| Dividends | 2,967,990 | 2,967,990 | ..... |
| Surplus | $286,779 | $268,839 | I. $17,940 |

Expenses include all expenditures for equipments brought forward from 1892, and about $1,100,000 expended for renewal and additions to equipment and betterment to road this year. Nothing has been charged to construction or equipment since 1883. The funded debt has been decreased during the year $250,000 by the operation of the sinking fund. The operating expenses were 72.03 per cent. of gross earnings, against 70.50 per cent. last year.

**Michigan Central.**—The earnings for the year ending Dec. 31, partly estimated, are as follows:

| | 1893. | 1892. | Inc or dec. |
|---|---|---|---|
| Gross earn | $16,075,000 | $15,908,000 | I. $167,000 |
| Oper. expen. and taxes. | 12,136,000 | 12,046,000 | I. 90,000 |
| Net earn | $3,939,000 | $3,862,000 | I. $77,000 |
| Int. and rentals | 2,401,000 | 2,404,000 | D. 3,000 |
| Surplus | $1,538,000 | $1,458,000 | I. $80,000 |
| C. S. rental | 473,000 | 381,000 | I. 92,000 |
| Balance | $1,065,000 | $1,077,000 | D. $12,000 |
| Other income | 46,000 | 47,000 | D 1,000 |
| Net income | $1,111,000 | $1,124,000 | D. $13,000 |
| Dividends | 1,030,601 | 1,030,601 | ..... |
| Balance | $80,399 | $93,399 | D. $13,000 |

All expenditures for improvements and betterments to the property have been charged to operating expenses. No charge has been made to construction account during the year. Operating expenses were 75.50 per cent. of gross earnings, against 75.72 per cent. last year.

**Minneapolis & St. Louis.**—In the District Court at Minneapolis Judge Smith has granted the petition ordering the Central Trust Company, trustee, of New York City, to pay over to the Receiver about $25,000 collected as interest on first mortgage bonds of the Minnesota Transfer Railway Company, deposited with it as collateral. Another petition was also granted, ordering the Receiver to pay the coupons of the various mortgages of the Minneapolis & St. Louis as they mature, and as he has money on hand to meet them.

**New York Central & Hudson River.**—The report of earnings for the six months to Dec. 31, following, includes leased lines, the results for 1893 being for a mileage of 2,334, an increase of 238 miles:

| | 1893. | 1892. | Inc. or dec |
|---|---|---|---|
| Gross earn | $24,046,000 | $24,265,880 | D. $219,880 |
| Operating expens. | 16,331,000 | 16,716,074 | D. 384,074 |
| Net earn | $7,715,000 | $7,549,806 | I. $165,195 |
| Fixed charges | 5,215,000 | 4,964,126 | I. 250,874 |
| Balance | $2,500,000 | $2,585,679 | D. $85,679 |
| Dividends | 2,235,700 | 2,235,707 | D. 7 |
| Surplus | $264,300 | $349,971 | D. $85,671 |

**New York & New England.**—Judge Wallace, of the United States Circuit Court, appointed Thomas C. Platt, of New York, a director, temporary Receiver for the railroad company on application before him at Albany, N. Y., on Dec. 27. The reasons for applying for the Receiver are not given out as we go to press, but it is understood that the company was about to default on interest due on Jan. 1.

**Northern Pacific.**—Judge Jenkins, of the United States Circuit Court, has taken under advisement the petitions of the Receivers for permission to pay the interest on the sinking fund charges on the first mortgage bonds and the one asking the Court to fix the annual compensation of each of the Receivers at $18,000.

**Old Colony.**—The time limit for the exchange of shares of the railroad company's stock for those of the New York, New Haven & Hartford expired last week. The basis of exchange was 10 shares of Old Colony for 9 shares of New York, New Haven & Hartford. The total number of shares exchanged was a few more than 55,000. The total number of shares of the Old Colony, according to the company's last report, is 131,675. A little more than 40 per cent. of the Old Colony stock has therefore been exchanged under the terms offered.

**Oregon Pacific.**—The State Court at Corvallis, Or., has set aside the recent sale of the railroad to the Bondholders' Committee.

**St. Louis, Alton & Terre Haute.**—The company announces that all the outstanding bonds of the company mature and will be paid on July 1, 1894. An arrangement, however, has been made with Drexel, Morgan & Co. and Vermilye & Co. for converting them into the first collateral trust mortgage, St. Louis Division four per cent. bonds of 1990, of the Cleveland, Cincinnati, Chicago & St. Louis company, to which the property covered by the Terre Haute bonds was sold in 1890. On July 1 next these bonds will have a first lien on the property mentioned.

**St. Paul Union Depot.**—An order has been made in the United States Court requiring the Northern Pacific to surrender $20,000 of the Union Depot Co.'s stock to the Chicago Great Western on payment by the latter company of $11,696. This was the test case in the matter of the Great Western becoming a joint owner in the depot property.

**Seattle, Lake Shore & Eastern.**—The Union Trust Company, of New York, secured an order from the United States Court at Seattle, Wash., on Dec. 23, to institute proceedings of foreclosure against this company. John H. Bryant, of New York, was named as Receiver to act in conjunction with the present Receiver, Thomas Brown, in the management of the road. The Seattle, Lake Shore & Eastern was formerly under control of the Northern Pacific. The latter has refused to pay the interest accruing since the Lake Shore was taken out of its hands and turned over to a receiver.

**Terminal Railroad Association of St. Louis.**—The company this week filed at St. Louis a second mortgage to secure to the Central Trust Co. of New York an issue of 5 per cent. gold bonds to the amount of $5,000,000. The mortgage was authorized last April, and the proceeds of the bonds issued under it will be used to complete the Union Station.

**Toledo, St. Louis & Kansas City.**—The suit of the Continental Trust Company, of New York, for the fore closure of this road under the first mortgage bonds has been consolidated with the original suit begun by Joseph S. Stout by Judge Ricks of the United States Court at Toledo. S. R. Callaway, who is named as Receiver in the original suit, has been continued in that position.

## TRAFFIC.

### Traffic Notes.

The Gulf, Colorado & Santa Fe has decided to extend the half-fare privilege to the clergy in Texas and Indian Territory after Jan. 1. It is the first road in Texas to do so.

A Washington dispatch states that the Post Office Department has arranged for a fast mail line between New York and Florida over the new line of the Richmond & Danville and the Florida Central & Peninsular.

According to a Houston (Tex.) paper about 1,200 passengers passed through that city on the night of Dec. 19, bound for points in Alabama, Georgia and other Southeastern States where they were going to make Christmas visits. They were all Texas people and went over the Southern Pacific.

A press dispatch from Ann Arbor, Mich., reports that the Toledo, Ann Arbor & North Michigan, in connection with the Wabash and the Toledo, St. Louis & Kansas City, reduced the round trip passenger rates to Chicago for the holidays to $4, and to St. Louis to $8. The disturbance is said to have grown out of the action of the Michigan Central in making a $5 round trip rate to Chicago for Thanksgiving Day, which it proposed to duplicate for Christmas and New Years.

The overland passenger traffic over the Southern Pacific in November was as follows:

| | 1st class. | 2d class. | Total. |
|---|---|---|---|
| Eastward | 1,348 | 1,831 | 3,179 |
| Westward | 4,793 | 6,468 | 11,261 |
| | 6,141 | 8,299 | 14,440 |

For November, 1892, the arrivals at San Francisco over the same lines were 8,977 and the departures Eastbound were 4,471.

The statistical circular issued by Peter Wright & Sons, of Philadelphia, shows that for the two weeks ending Dec. 15 the receipts of wheat and corn from the West fell off at Philadelphia and New York about 376 cars, while at Baltimore the receipts increased 272 cars, as compared with the preceding two weeks. As compared with the same period of last year, the first half of December shows a falling off of two-thirds at New York and Philadelphia, while at Baltimore the receipts have more than doubled, though the absolute increase at the latter port is only about one-sixth of the decrease at the other two.

### Chicago Traffic Matters.

CHICAGO, Dec. 27, 1893.

As stated in my dispatch last week, the Union Pacific, Great Northern and Northern Pacific finally decided to proceed to the restoration of trans-continental passenger rates on Jan. 1, leaving the question of the allowance of a differential to the Canadian Pacific to be settled at a meeting called for next week. The latter is willing to advance rates provided it is allowed a differential of $10 for first class and $5 second class, via both Winnipeg and the "Soo." The other lines are willing to allow these differentials via Winnipeg, but object to the allowance via St. Paul. The general opinion at present is that a compromise differential will be arrived at for St. Paul. Repeated efforts have been made to induce the Canadian Pacific to join in an advance, which have been met with the assertion that it was entirely willing to join in a general advance whatever the other lines agreed, but claiming, with reason, that inasmuch as the action of the Great Northern was the direct cause of the disturbance it should not be asked to join a new agreement until the other lines first agreed. Now that this has been accomplished it remains to be seen whether the Canadian Pacific is acting in good faith, or whether, as has been all along claimed by the other lines, it was only using the situation as a cloak to cover up its own intentions.

The new rates between St. Paul, Minneapolis, Duluth and West Superior, and Portland, Seattle and North Pacific Coast points are: First-class, 30 days limit, $70, in both directions; continuous passage, $60; second class, continuous, $35 westbound, and $40 eastbound; round trip, nine months limit, $80 westbound, and $90 eastbound.

On Dec. 21 the Joint Committee in session at New York resolved "that all eastbound rates except those or dairy products be restored Jan. 1 to the tariffs in effect prior to Nov. 28 last; it being hereby pledged that there are no existing contracts, quotations or allowances in conflict therewith, nor will any be made as to dairy products. It is agreed that the rates shall be made Jan. 1, on the basis of 50 cents per 100 lbs. Chicago to New York for dairy products classified first class and 45 cents for those classified second class, and that March 1 said rates be fully restored to 75 and 65 cents respectively." On the same day the Erie published another tariff, showing a further reduction in rates on grain and grain products from Chicago to Eastern seaboard and intermediate points on a basis of 15 cents per 100 lbs. to New York, effective Dec. 21 and expiring Dec. 31. The belief is quite general here that the proposed restoration on Jan. 1 will not be maintained even if put into effect, as none of the questions underlying the trouble have been settled. The other eastbound lines are not unanimous in meeting the last reduction on grain, some of them preferring to let the 17½ cent basis remain in effect until Jan. 1.

The Joint Committee, having considered the reports of demoralization in eastbound passenger rates, has ordered the sale of tickets at cut rates to be stopped on Jan. 1, and will hold a meeting Jan. 9 to consider the commission question.

The attempt of the Western Passenger Association members to restrict the use of reduced holiday rates to points within a radius of 200 miles was a failure, and reduced rates are being freely made in all directions and for all distances where there is a prospect of securing business.

The through rate from Chicago to what are known as North Pacific Coast points agreed to for advance Jan. 1 is $71.50, continuous passage.

The indications are that the "land seekers'" reduced rates offered by the Illinois Central in connection with the Mobile & Ohio, will cause considerable demoralization in all Western rates. The Wabash already has announced half-fare round-trip rates from all points on its line to all points where these reduced rates have been quoted.

It is stated that as high as 50 per cent. of the tariff rate is now being paid as commission on eastbound passenger business.

It is reported that the Indiana, Illinois & Iowa is to make a traffic contract with the Louisville, New Albany & Chicago similar to that now inforce with the Chicago & West Michigan, by which the three I's is enabled to deliver freight to all the Eastern lines. The report cannot be confirmed. The reason given for the change is that the grades via the Monon are much easier than those of the West Michigan, thus enabling quicker time to be made.

The low rates on grain, coupled with the announcement of an advance Jan. 1, have so stimulated the eastbound movement that some of the roads, notably the Pennsylvania and the Michigan Central, are experiencing considerable difficulty in keeping it moving.

(*Other Chicago traffic news will be found on page* 953.